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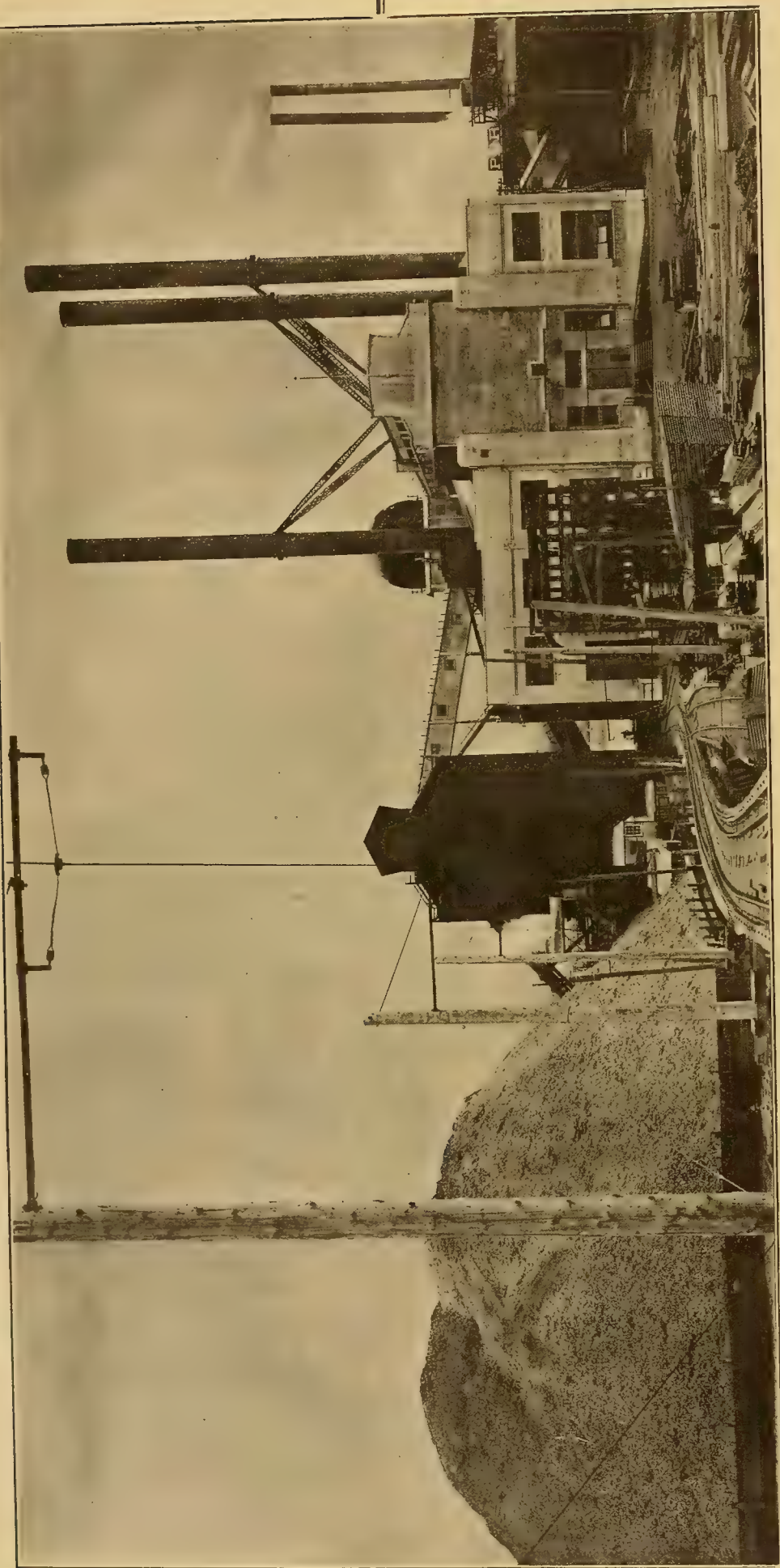
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THE INSISTENT DEMAND FOR NEW FUEL

WITH oil rapidly mounting in price and being more in demand for other uses where its high heat content makes it invaluable, and coal as yet not developed in sufficient quantities on the Pacific Coast; the possibilities and economies of other fuels are receiving increased attention. The great Northwest—where the immense lumber industries preponderate—offers a solution of this problem through the use of saw mill refuse called “hogged” fuel. The plant above, that of the Northwestern Electric Company at Portland, Oregon, has been designed to utilize this fuel, and on other pages of this issue is fully described.



JOURNAL OF ELECTRICITY



DEVOTED TO THE UPBUILDING OF THE ELECTRICAL INDUSTRY IN THE WEST
AND IN THE COUNTRIES BORDERING THE GREAT PACIFIC

Volume 45

SAN FRANCISCO, JULY 1, 1920

Number 1

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A WATER POWER LAW AT LAST

ON June 18 announcement was given from the office of President Wilson that the Water Power Bill had been signed as of date prior to June 11, on which date the period provided by the federal Constitution for the signing of bills passed by the closing Congress ended. In the final establishment of this law, the West, which is so directly concerned with electrical affairs, has a feeling of the greatest satisfaction. At the same time an active campaign should be launched to show those not intimately familiar with the water power situation that this bill has more direct effect on them than any other measure that has been up for consideration for many years. We of the electrical industry know full well that the unhampered development of the tremendous natural resources of the West is inseparably bound up with the development of our water power and therefore we must in nowise neglect our duty to tell this on every occasion.

At the recent Pasadena convention of the National Electric Light Association the conclusion was reached to continue in office the present Water Power Development Committee of this Association for the purpose of aiding in the formulation of regulations for the administration of the Water Power Act. To show that the industry does have such an interest in this measure, no time must be lost in this work. It is the actual interpretation and administration of this Act which will tell whether the public at large will get full value from it. This interpretation and administration must give a broad sympathy and unhampered encouragement to those who invest their monies for its fulfillment. Let us all work now to see that those broad ideals are brought into practical application.

At the A. I. E. E. convention at Portland, July 21 to 24, the principal topic to be discussed is that of suspension insulators. The program committee has done well to make these plans as this subject is without doubt foremost in the minds of Western engineers at this time when the development of large water powers is being actively pressed.

Of particular interest among these papers are the ones by Professor H. J. Ryan and F. W. Peek, Jr., which cover the subject of insulator shielding. It appears that the only practical way in which the higher voltages which will be required within the next few years may be operated, is by the use of insulator strings so shielded that the unit duties imposed on any one of the units may be kept below the critical value which lies in the neighborhood of 20 kv. Above this value there is the possibility that surges on the line will increase the duty on the line unit to such a figure that this unit will arc over and, by cascading, the entire string will be shorted.

With the improvements in design outlined by Ryan and Peek the only other bar to 100 per cent insulators is refinement in manufacture. The processes now in use are satisfactory, yet the technic of firing has not reached perfection. To get this the users of insulators must be prepared to pay real money for the units put to use so that the manufacturers will be compensated for the units discarded in selection and testing.

Great care should be observed in selecting men for office. Because a man is a great engineer should not necessarily fit him for holding office. Rather is the attitude of mind of the candidate to be weighed. The gift of office is the expression of confidence on the part of the membership in the proposed candidate, looking toward enlarged opportunity for service.

The different engineering societies seem to be divided into parties, formed by geographic lines or by the different sub-divisions of that branch of the industry they formed to improve. Each branch of the industry and every section of the country should be represented on the council to uphold the position of their respective sections of the nation.

The men chosen for the executive positions should if possible be near the top in their profession and should have the highest ideals coupled with extended knowledge of all the branches of that profession. Only such a man can safely guide the organization into its place in the solution of the tremendous industrial issues precipitated by the anti-climax of the war.

The West, with its acknowledged leadership in hydroelectric development, mining operations, and large construction works, should be the logical place to find the man with the necessary requisites for the leader of an engineering society. For a man to be near the top of his profession in the West means that he must be a man of the highest ideals, with a

broad vision, and one who has met and conquered the many problems that come to the pioneer.

Let the various engineering societies in these days of unrest set themselves up as models of proper government and show, in their choice of executives, the value of the engineer in politics due to his farsightedness in choosing the right man for the place, regardless of all else. An engineer is by nature constructive, no matter what branch of the profession he represents; therefore let him apply to his politics the same constructive vision he applies to his business and to his profession.

While, however, we advocate engineers of the West as possible candidates for office, we must not lose sight of the fact that the vast distances separating us from Eastern centers must perhaps, for some time to come, act as a slowing-up process in bringing into full action the vision that today prevails throughout this vast domain.

One of the most powerful new thoughts brought out at the recent Foreign Trade Convention held in San Francisco, and also at the convention of the National Electric Light Association at Pasadena, was the utterance of Henry Suzzalo, president of the University of Washington, on the subject of "Alternate Leadership"—a combination of words upon which he dwelt with considerable emphasis.

We do not understand that his use of the word "alternate" in combination with the word "leadership" is meant to convey that responsibility for citizenship is for one moment vested in one individual and the next moment in another, but rather that a reciprocal leadership in thought should be the order of the day. In order to make this possible, President Suzzalo forcefully brought home to his hearers the fact that a certain humility is necessary on the part of every citizen in his attitude toward others who are experts along certain lines of thought, and in turn these others should have a certain attitude of humility toward the speaker when he in turn speaks with authority on subjects wherein he can qualify as an expert.

The development of this ideal of alternate leadership is another phase of the great cooperative ideal that is sweeping this country, namely, that the other man and his problems and his viewpoint be given at all times the weight they deserve in any phase of the discussion. He who endeavors to sit in judgment upon every question of the day and speak authoritatively on its problems, irrespective of his qualifications to pass such judgment, cannot long retain the esteem of his fellows. President Suzzalo in this recent pronouncement of his has given us a clearer conception of an ideal of leadership toward which we may all work, endeavoring to kindle within ourselves the necessary humility willingly to hear authoritative statements of opinion on broad problems of the day from each individual citizen qualified to speak.

The electrification of railways; the economic development of our water powers; the handling of diffi-

cult and perplexing technical problems such as inductive interference on the one hand, and of the purely commercial problems such as the merchandising of electrical ware on the other,—these are all matters of great present day importance, and in the solution of these problems the executive, the business man, the engineer, each in his field, must be granted his share of alternate leadership.

In this day of scarcity of fuel oil and increasing cost of this product, power plant managers, executives and engineers will do well to give added attention to the details of boiler room operation that lead to increased economies.

One instance is that of being able readily to clean the scale from boiler tubes.

There have been many compounds of a chemical nature invented to handle the various sediments and scale formation that take place in the operation of the modern steam power plant. A little common sense in the method by which the cleansing process is attacked will go a long ways toward effective results. Indeed, attention to one little detail will often soften the scale formation and will be found very effective. Thus it is found that when time permits in the operation of the steam power plant, the boiler should be left full of water for two or three days after a shutting down takes place for the cleansing process. This lying idle, as it were, prevents the scale baking to the tubes so that it remains softer and is far more easily removed. Other instances of care and patience will effect a decided improvement in the cleaning of boiler tubes and increased efficiency in the power plant.

The power company engineer has often felt that his investigations, and the advice based upon them, which he had to offer were looked upon by the power company management as matters of interest but not of importance. If the company's lawyer comes forward with a question of policy or legality, the matter is given immediate consideration, as vitally affecting company welfare. Suggestions from the engineering department, however, have been too often pushed aside by apparently more urgent business until the results of a failure to realize the importance of a problem force it to the foreground. The imperative necessity of adopting a fixed policy on inductive interference before the attitude of greater preparedness of the telephone interests forces an entire revision of the transmission system, has called to the attention of the power company management the acuteness of some of these engineering matters. In the carrying out of the tremendous financing plans which are on the slate for the next decade, no loophole which might lead to unfortunate relations with the public should be allowed to slip by. The vigilance of every department is needed in the formulating of company policy, and none more than that of the engineer, who alone can foresee and analyze the strictly technical problems which continually arise.

One unexpected result of the greatest moment to the power companies of the country was achieved through the discussion of the public policies and financing at the Pasadena convention, namely, the realization by the Investment Bankers' Association of the value of a close affiliation with the National Electric Light Association; and this not with the entirely altruistic motive of benefiting the electrical industry, but in order to benefit themselves through the application of the principles of self-interest. This is a step toward the solution of the pressing problem of securing the millions of dollars so vitally needed for financing, particularly in the West. With the bankers represented on the N. E. L. A. committees, an intimate knowledge of the workings of the utilities and an understanding of their ideals will be transmitted in a way that years of propaganda work could not accomplish.

Discussions of prices, and opinions as to their probable further rise or possible decrease, have been forthcoming without limit; government agencies, commercial bodies, financiers, manufacturers and consumers have worried and studied over it—and for every guess on one side there is another and perhaps as good a guess, on the other. All this is entirely justified. With the dollar of today worth only a trifle over forty cents as compared with that of 1913 the question is of course the most vital one at this time.

A ray of hope for the struggling wage earner is seen in the slight decreases in some commodities recently, and another sign, specially interesting to the electrical industry, is the report that a number of the manufacturers of equipment have so nearly caught up with back orders that they are in a position to go after orders rather than have the orders come to them. If such continues to be the situation a decrease in prices might result from the resulting competition. In general the conclusion is reached, however, that no marked decreases will result within the next year and a half.

The great state of Montana which in past years has offered so many constructive ideas in engineering, is now, through its regulatory body, the Montana Railroad Commission, undertaking a new and helpful work. This commission during the past year has been assisting the smaller companies to run their plants more efficiently and to adjust themselves to changed conditions and high prices. Increased rates do not always solve the problem. In some cases a theoretical increase has actually resulted in a decrease in revenue. This commission has found it possible by a close study of the plants to suggest changes in methods of operation that result in a decrease of overhead expenses sufficient to make rate increases unnecessary.

This system of procedure enables the smaller companies to compete with the larger companies which are able to keep a large force of engineers who

naturally institute the economies that cut down overhead expense. With the engineers of the commission performing the duties of consulting engineers for the smaller companies there will be fewer rate cases for them to investigate and fewer valuations to be made, giving them more time to be of help to the companies. Commissions were formed to protect the company and the consumer, to insure good service to the consumer at a fair rate to both producer and consumer, and to act as an impartial judge in cases of dispute. By increasing the efficiency of the companies under its jurisdiction this commission is doing a constructive work that will make its other work unnecessary and will do a lot towards bringing about a real cooperation between the consumer, the company and the commission.

There seems to be little question in the minds of electrical men that Western railroads will eventually be electrified, the time at which this vent is to occur depending upon the moment at which the operating men of the railroads can be convinced of the economical value of this step compared to other improvements along old established lines—and, as a related factor, the rising price and scarcity of fuel.

Foreseeing that all main lines will be electrically operated within a comparatively short time, therefore, it is imperative to consider the problems which will arise from their inevitable interconnection. The electrical industry has long suffered from the fact that it realized too late that electric generation was not a local problem and that it permitted electric systems to grow up under entirely different conditions in different parts of the country, with resulting difficulties when it comes to interconnection at the present time. Electrified railroads are now in a fair way to make a similar mistake, but with the warning of the 50-60 cycle problem before them, no such barrier to future development should be permitted to develop. Not only rolling stock and engines, but power will inevitably be passed along from one section of electrified road to another. The question of standardization is one which should be studied by railroads and manufacturers alike in the interest of future needs as well as the immediate present.

The power shortage which faced the whole West this season and led to the establishment of strict regulations regarding the use of power is not as great as was at first feared. This is shown by the conditions now prevailing in California where the cold weather during April and May which retarded the run-off in the mountains, and an unusually heavy snowfall in the higher elevations have brought about a more optimistic estimate of the amount of power available. The previous figure of 114,000,000 kw-hr. shortage was spread over seven months, and was about 10 per cent of the total estimated load, while the present estimated shortage of 70,000,000 kw-hr., or seven per cent, will only last six months. These figures are based upon the latest

Interest of Financiers in N. E. L. A.

Trend of Prices

Constructive Commission Regulation

Standardization in Railway Electrification

A More Optimistic Outlook on the Power Situation

chart prepared by the power administrator of the California Railroad Commission which is reproduced in the news columns of this issue of the Journal of Electricity.

It must be remembered, however, that these figures are based upon a most optimistic forecast of conditions, and that any unusual weather conditions might again increase the shortage. Power users that have adopted conservative measures should continue these, as any more ambitious plans would be liable to curtailment. In view of the recent agreement between the power companies of California and the power administrator not to accept any new power contracts of fifteen horsepower or over without first referring them to the power administrator, it can readily be seen that the crisis has not been passed. There is still need of conservation of power and before the summer is over certain of the non-essential users of power may be restricted. Therefore those consumers who have arranged their business to operate under the ten per cent shortage should continue to operate as heretofore, and allow those new industries which have sprung up this year to utilize any of the extra power that might be available under this new, more optimistic survey.

A record of what is taking place in the combustion chamber of the steam electric power plant is a matter of great importance in so far as the economy records of each day are concerned. Engineers will do well to see to it that the most improved methods in keeping this record are put into practice. The simple Orsat apparatus is used very extensively in many power plants. It is reliable and accurate and its only drawback is that it is a somewhat delicate instrument and requires careful manipulation.

Watching the Chimney Gases

There are on the market other instruments that are more rugged construction, and, therefore, more suitable for power plant work, by which it is possible to determine the CO_2 only. While for any scientific investigation or accurate test it is necessary to determine the oxygen and CO as well as the CO_2 , there are many cases in practical operation where the determination of the CO_2 alone is very valuable; therefore, the simple instrument by which this can be done has a useful place in power plant work.

One of these instruments consists of a metallic vessel into which is pumped a charge of the flue gas to be analyzed. The vessel contains a small quantity of caustic potash solution for the purpose of absorbing the CO_2 in the sample. As soon as the gas is taken into the receiver the cocks are closed and the instrument is shaken to mix the gas thoroughly with the absorbent solution, thus removing the CO_2 content. A small amount of mineral oil floats on top of the caustic solution to keep the gas from coming in contact with the caustic until after the cocks are closed and the instrument shaken. Removing the CO_2 in the gas reduces either its volume or its pressure. In this case, the volume remains constant and consequently the removal of the CO_2 reduces the pressure in accordance with the well known Boyle's law. The reduction in pressure is measured by a small vacuum gauge which is calibrated to read in percentage of CO_2 .

Another instrument is a compact portable type that operates on the same principle as the Orsat and makes accurate CO_2 determinations. There are many other types on the market that for particular instances are accurate, handy and of easy application in the power plant. No central station manager or engineer looking toward increasing economy in his power plant can afford to overlook the necessity of constant and accurate records of what is taking place in the combustion chamber.

More than half

of the industrial plants of the country
are inadequately illuminated.

In the next issue, in addition to others vitally important, the subject of Better Lighting will be covered.

A new series on elementary electricity will also begin in that issue.



The city of Portland in which the 1920 Pacific Coast Convention of the A. I. E. E. will be held

Pacific Coast Convention, A. I. E. E.

(With transmission voltages reaching ever higher it is reasonable that this convention should give most emphasis to the discussion of the subject of suspension insulators. Herewith are abstracted a few of the papers which will be presented at Portland during the sessions which will extend from July 21 to 24. In order to aid in stimulating interest in this convention and increasing the attendance, the Journal of Electricity has made special arrangements to give advance publication to the papers. There will be eight convention papers.—The Editor.)

ELECTRICAL CHARACTERISTICS OF THE SUSPENSION INSULATOR

BY F. W. PEEK, JR.

At present voltages the insulator problem is primarily a mechanical one. Due to the unreliability of porcelain in tension, the greatest care must be exercised in manufacture to secure a satisfactory product, and it has been found that even the most careful test will not eliminate deterioration after several years of use. This deterioration is due to gradual mechanical cracking or gradual absorption of moisture due to porosity, with the greater portion of the cracking caused by expansion of the cement and tight fitting metal parts. These causes of deterioration are not met with in the type of insulator in which the porcelain units are strung together by loose fitting metal parts, even though the insulators were made of poor material. The solution of the deterioration problem seems to be to start with a design as free as possible from expansion troubles and the selection of a non-porous porcelain. This selection would best be attained by testing a small percentage of the product to destruction daily.

It has been determined that insulators in series in a string have not the same arc-over voltage as the sum of the arc-over voltages of the individual units, but less. The curves of Fig. 1 show this voltage distribution. Fig. 2 shows that for strings of over five units about 30% of the total voltage is across the insulator nearest the line.

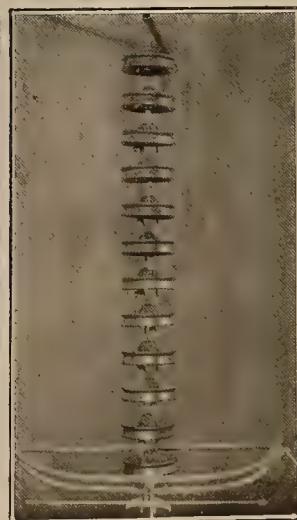
As a string of insulators may be considered as made up of a number of capacities in series, it is

apparent that the capacity currents cause an unequal voltage distribution which may be corrected by increasing the capacity of the insulators without increasing the capacity to earth; by increasing the capacity of the insulators in proportion to the currents flowing through them or by elimination of the ground capacity by means of antenna shield. Of these three possibilities the third is quite practical and gives good voltage distribution.

Although heretofore the main argument given for equalizing voltage distribution has been to reduce the string length by increasing the arc-over voltage for a given number of units, it is much more impor-



Grading by metal caps



Antenna shield for equalizing the voltage on insulators

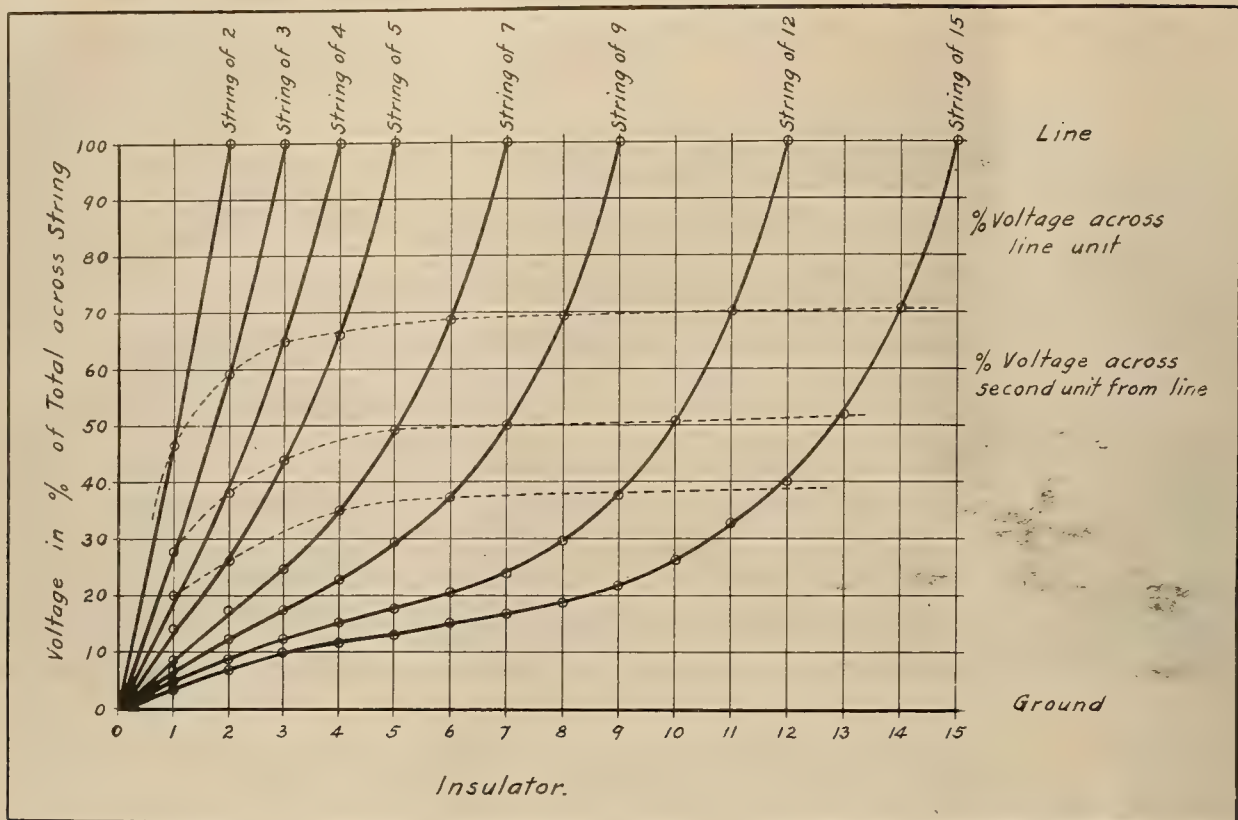


Fig. 1.—Typical voltage distribution curves on strings of suspension insulators.

tant to reduce the operating stress on the line-end units. The following points are arguments in favor of grading:

(1) A string cannot be greatly shortened in practice by grading because of the effects of rain, dirt, etc. (2) Rain would not increase the wet arc-over voltage of a graded string. (3) The wet arc-over voltage would generally be lower if the string were decreased.

There is an additional reason why grading will generally not make possible an increase in the arc-over voltage or decrease in the string length. For any un-balanced string there is more or less complete automatic grading as the arc-over voltage is approached. Near arc-over excessive corona forms on

the line unit, to a less extent on the next unit, etc. These sheets of corona act as capacity plates and grade the string, thus automatically raising the arc-over voltage.

Summary.—For the very high voltages at present being considered greater reliability may in many respects be anticipated than for the lower voltage lines. The lighting arc-over voltage and dielectric strength will be relatively higher, and induced lightning voltages sufficient to cause arc-over will be less than on low voltage lines. Unequal distribution can be corrected by shielding. Shielding prevents excessive corona on the line end units, and tends to direct the power arc away from the string. The maximum unit stress on a 220-kv. shielded string can be made less than on a 100-kv. non-shielded string. And, therefore, outages due to insulator troubles will probably be less frequent at the higher voltages than at present.

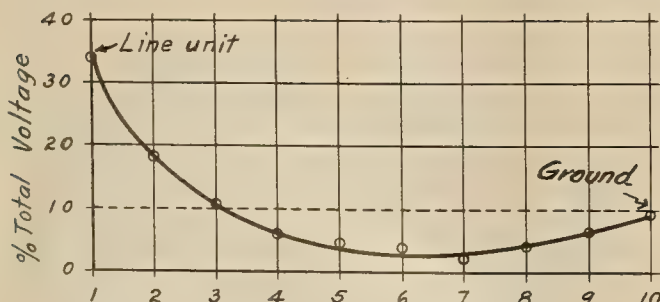


Fig. 2.—Voltage distribution curves on string of 10 insulators. 30 per cent of the duty falls on the line unit.

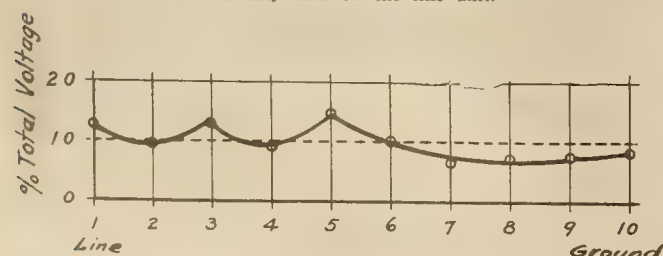


Fig. 3.—Voltage distribution on ten-unit string shielded with metal caps on units.

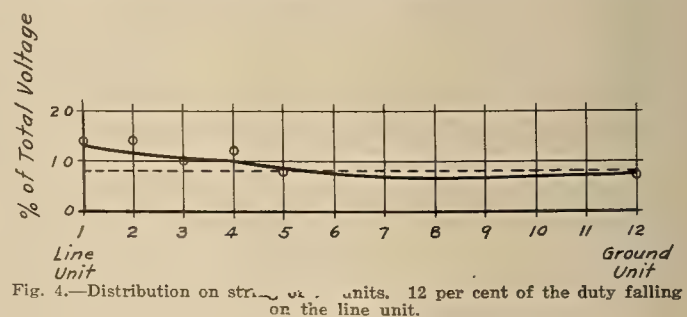


Fig. 4.—Distribution on string of 12 units. 12 per cent of the duty falling on the line unit.

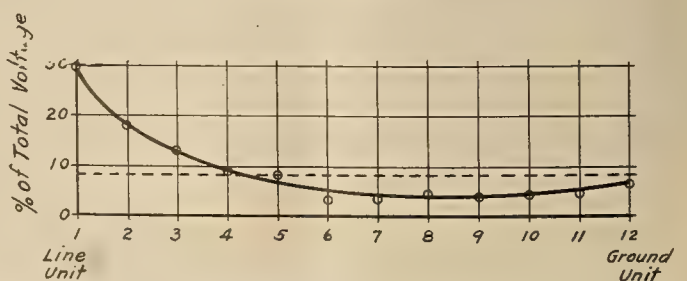


Fig. 5.—12-unit string after shielding with metal caps on units. Line unit has only slightly more than the average duty.

UNIT VOLTAGE DUTIES IN LONG SUSPENSION INSULATOR STRINGS

BY HARRIS J. RYAN AND HENRY H. HENLINE

This paper deals with potentiometer measurements of the maximum and average unit voltage duties occurring in insulator strings made up of 10-in. bomb and link type units in which the relation between the unit maximum voltage duty, number of units in the string and three-phase line voltage is given by the equation:

$$e_{ma} = \frac{d_r e}{1.73n}$$

wherein e = three-phase line voltage
 e_{ma} = maximum voltage unit duty
 n = number of units in string
 d_r = corresponding duty-ratio.

By means of this equation duties were determined for line voltages of 110, 150, 175, and 220 kv.

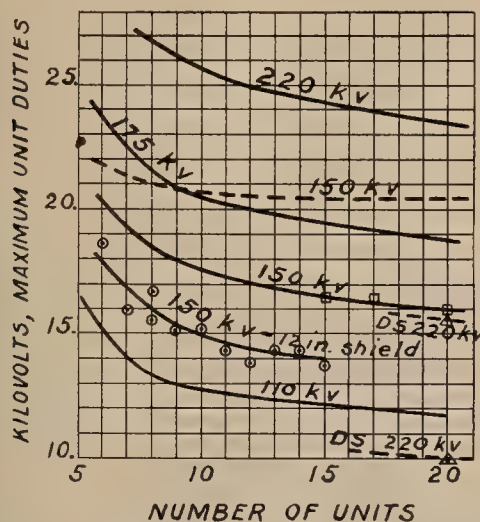


Fig. 1.—Maximum unit duties in kilovolts for various length strings and line voltages, for both shielded and unshielded units.

An inspection of the curves in Fig. 1 of the value derived in the above manner reveals the fact that when maximum and average voltage unit-duties are assumed to be limited to 18 and 10 kv. respectively, the upper limit of line voltage will be 150 kv. Increasing the number of units from 9 to 20 will lower the maximum voltage from 18 to 16 kv. only. An increase in string length from 10 to 20 units will cause a corresponding increase in flash-over voltage of only 9 per cent.

When used to support and insulate a 220-kv. line a 13-unit cap and pin string would operate at maximum and average voltage duties of 25 and 10 kv. respectively. Many engineers feel that a duty of 25 kv. for a single 10-in. unit is too high because of corona formation and the lowered factor of safety against flash-over by cascading. This latter factor shows the value of a radical departure in the design and construction of the units whereby they would endure satisfactorily under higher maximum voltages. It is generally conceded, therefore, that in the present state of the art some additional means must be employed in suspension insulators for the 220-kv.

or 250 kv. lines whereby the maximum unit-duties will not be excessive.

These maximum duties may be lowered by one or more of the following expedients:

- I. Increase in size and capacitance of some or all of the units; grading.
- II. Increase in the number of strings in the insulators.
- III. Use of static shields.

A large number of measurements have been made by the authors for the purpose of illustrating the effect that the use of a small static shield would have upon the maximum voltage duty in a single string.

It appears that the ten 10-in. cap and pin unit string equipped with a 12-in. static shield would serve as satisfactorily for the insulation of a 175-kv. line as the corresponding nine-unit string without shield now serves on a 150-kv. lone.

It is seen that by the practicable expedient of increasing the capacitance of the units the maximum voltage duty in the long string may be lowered from 30 to 11 kv. with an average voltage duty of 10 kv.

Not until the manufacturer has amply demonstrated, by economic quantity production, his immediate readiness to deliver durable units in which radical changes have been made in design, size, and mechanical and electrical duty resulting in extra high voltage line insulators having an aggregate superiority in essential qualities over those made at present, can the transmission engineer count upon the use of units materially different from those in use for the support of extra high voltage lines.

A great number of tests of the maximum and average voltage unit duties in line suspension insu-

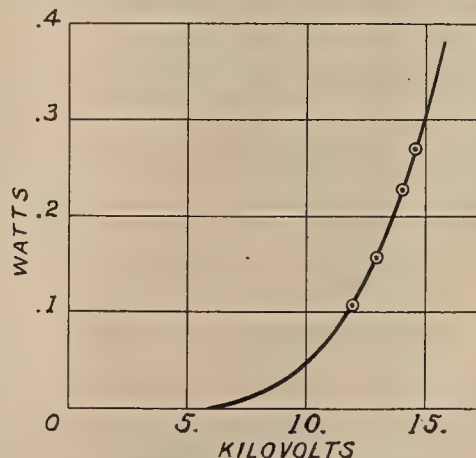
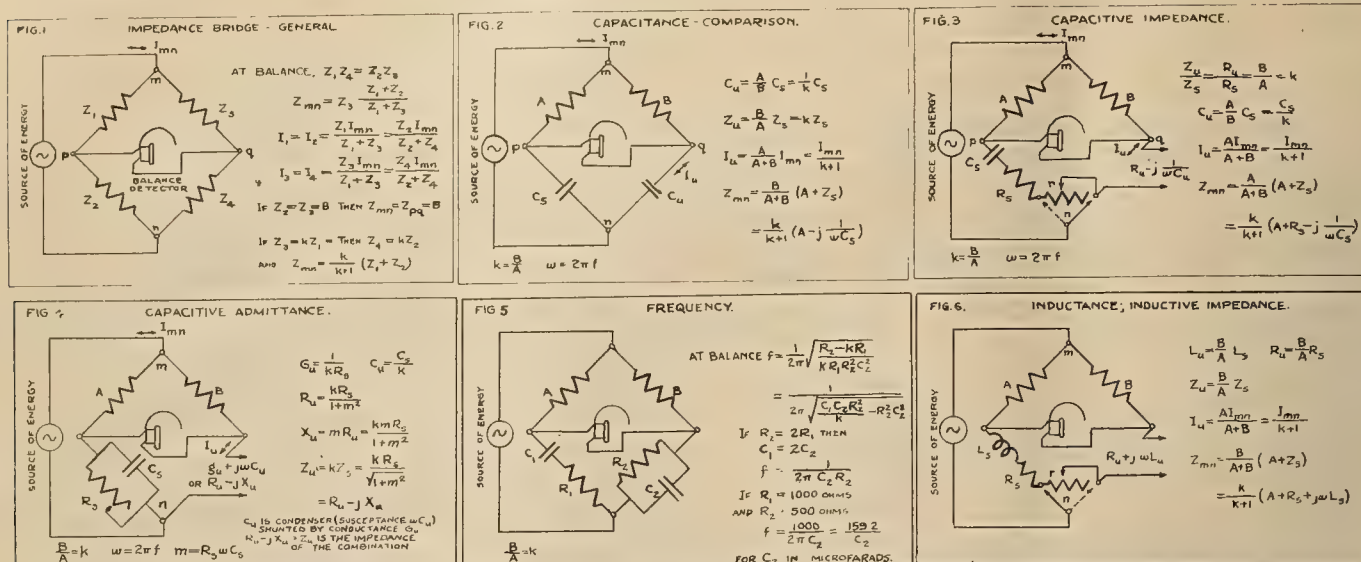


Fig. 2.—Power loss in 10-in. units for various unit duties.

lators made up of units in common use have been made. Duties values have been plotted for single and double strings with and without shields, the latter of various dimensions for voltages of 173 kv. and 208 kv.

Conclusions: 1. Suspension insulator units in common use can be satisfactorily employed for the make-up of insulators for 250 kv. lines. 2. Increase in the number of units in suspension strings will permit the use of a limited increase in line voltage. 3. Static shields in requisite forms will lower the maximum unit voltage duties so as to permit the satisfactory insulation of lines for the use of voltages far above 150 kv.



Charts showing the six outstanding arrangements used in the so-called bridge method of testing which stands out above all others in the history of electrical measurements

BRIDGE METHODS FOR ALTERNATING CURRENT MEASUREMENTS

BY D. I. CONE

Eminent in the history of electrical measurements is the so-called bridge method of testing, the fundamental principle of which is the equalization of the potentials of two chosen points in a network of electric circuits. The original application of this principle was made in 1833 to the measurement of resistance to direct current in the arrangement long familiarly known as the Wheatstone bridge. Later developments cover the application of the bridge principle to the measurement of impedances of alternating current circuits. However, the Wheatstone bridge, as used with direct current can be used for alternating current testing by applying the principle that all the numerical formulas and rules of quantitative behavior for continuous current circuits are exactly the same as for a single frequency alternating current circuit, if these rules are interpreted as relating to complex numbers.

The first consideration in the use of practical forms of bridge work in alternating current testing is the replacement of the four resistances of the direct current Wheatstone bridge by impedances. In place of resistance is written the impedance

$$Z = \sqrt{R^2 + X^2} \quad \theta = R + jX$$

Where R = effective resistance

X = effective reactance (+ if inductive, — if capacitive)

$$\theta = \tan^{-1} \frac{X}{R}$$

The arrangements used in practice to secure greatest sensitivity for a given departure from the balanced condition depends upon the impedances of the branches, including the balance detector and energy source and the kind of circuit being measured.

Of the various bridge arrangements given in the paper, the following may be noted:

1. Impedance bridge general.
2. Capacitance comparison as arranged by De Sauty.

3. Capacitive impedance as arranged by Wien, the latter where the power factors of the standard and unknown condensers are different and in general for measurement of capacitive impedance, including both resistance and capacitive reactance components.

4. Capacitive admittance where the standard resistance and condenser are in parallel which may be designated as an admittance bridge.

5. Frequency bridge using resistance and capacitance only connected in series on one side and in parallel on the other.

6. Inductive impedance for the direct comparison of inductances and the measurement of inductive impedances.

Other methods of bridge measurement are shown as alternates to the above for the measurement of factors less often encountered in practice, such as capacitive or inductive impedance, inductive or capacitive impedance, mutual inductance-capacitance-frequency and others.

SAW MILL REFUSE, POWDERED COAL AND OIL FUELS

BY DARRAH CORBET

(This paper gathers together such data as is available on the subject of the utilization of saw mill refuse, together with notes on powdered coal and oil fuel. As the latter two fuels have been treated extensively in the past, only the first has been covered in this brief abstract.—The Editor.)

Saw mill refuse consists of wood of every kind and size, from the finest dust to blocks as large as a 12-in. cube. The present practice is to run these larger blocks through a "hog" which cuts them up into chips the size of one's finger, thereby obtaining a more uniformly sized fuel.

Characteristics of Principal Western Mill-Refuse Fuel

Name of Wood	Location	Percentage moisture	Fuel value
Cedar	Western Wash., Ore. & B. C.	45—55	Fair
Cedar	Central California	40—50	Fair
Fir	Wash., Ore. & B. C.	35—45	Good
Fir	Central California	35—50	Poor
Hemlock	Wash., Ore. & B. C.	40—50	Poor
Pine—cork	Eastern Wash. & Idaho	35—45	Fair
" white	California	30—45	Fair
" sugar	California	40—65	Poor
" yellow	Central California	40—45	Fair
Redwood	California	45—50	Poor

The above table refers only to the moisture content, and it is interesting to note that the dry, non-resinous woods have practically the same heat content—8500 B.t.u. per pound.

One of the reasons why mill refuse has not been used more extensively is the difficulty of transportation. Only recently has it been transported any distance and even now seldom over 100 miles, the chief obstacle being the difficulty of getting an economical load on the cars or barges due to the lightness of the fuel. The best method evolved for moving this fuel over short distances has been to scrape it over smooth surfaces or blow it through pipes. Conveyors are less satisfactory, except in some instances in moving the fuel from the pile to the boilers.

In the storage of this fuel it has been found best to store it in the open, using some means of reclaiming it later, as long stacking causes it to pack. The two largest outdoor storages yet tried are at Station L of the Portland Railway, Light & Power Company and the new plant of the Northwestern Electric Company. Storage in the open has not been found to spoil the fuel, although it increases the moisture content. This latter may, however, be easily corrected.

Furnace Details

In the firing of hogged fuel the simplest method, and the most economical from a labor standpoint, is to run it into the furnace in a continuous stream, letting it pile up on the grate, either using one or two piles as conditions warrant. The ideal furnace design is one 6-ft. wide, although furnaces up to 12-ft. length have been successful. As high furnace temperatures are desirable in using this fuel, the throat of the furnace should be restricted by running the bridge wall up as high as possible without interfering with the draft; the area of throat left should be from 6 to 14 sq. in. per rated horsepower. A combustion space should be provided back of the furnace as hogged fuel has a large volatile content and tuyeres and a door or damper to control the admission of air must also be provided. Under any circumstances the arch should extend beyond the point where the supplementary air is admitted.

The following results of one test from among a number run on Station L of the Portland Railway, Light & Power Company give a good conception of the use of this kind of fuel. This test is the one which gave the best results; some other final results are given for comparison.

Test at Station L of Portland Railway, Light & Power Co.	
Kind of boiler.....	B & W.
Kind of firing.....	Riley stoker
Grate surface.....	114.5 sq. ft.
Date.....	Mar. 12, 1920
Duration.....	6 hours
Steam pressure.....	187 lb.
Temperature of steam.....	572° F.
Weight of fuel as fired.....	49,961 lb.
Total equiv. evaporation.....	164,068 lb.
Dry fuel per hour.....	5,395.8 lb.
Dry fuel per hour per sq. ft. grate.....	48 lb.
Equiv. evaporation per hour.....	27,344.6 lb.
Equiv. evap. per hr. per sq. ft. heating surf.	6.16 lb.
Percentage of rated capacity developed.....	178%
Equiv. evaporation per lb. of dry fuel.....	5.06 lb.
Equiv. evaporation per lb. of combustible.....	5.32 lb.
Efficiency of boiler, furnace and grate.....	60.1%
Efficiency based on combustible.....	58.5%

The following are comparative results of some of the other tests made on the same plant. The principal variants in the tests were the kind of firing and arrangements of furnace, all these tests being run with extended Dutch ovens.

	Test No. 1	Test No. 2	Test No. 8
Percentage of rated capacity.....	114%	91.8%	158%
Equiv. evap. per lb. of combustible.....	3.65 lb.	4.95 lb.	4.31 lb.
Efficiency of boiler, furnace and grate.....	38.4%	53.7%	47.7%
Efficiency based on combustible.....	38.5%	54.6%	47.2%
Kind of firing.....	doublechute	hand fired	four chutes
Arrangement of furnace.....	normal	short grates, low bridge walls	short grates, bridge curtain walls

This paper includes a curve of comparative values of wood and oil fuel; with cost of wood or oil up to \$3.40 per bbl. or per unit of 200 lb. A typical calculation from this curve includes evaporation per lb. of oil, cost per bbl., and the per cent moisture in the mill refuse. \$1.00 oil is found to equal hogged fuel at \$2.25 per unit and \$2.00 oil to equal \$4.50 hogged fuel.

Instances are found where the smaller users of power such as laundries have found a decided advantage in the use of hogged fuel even though they have it brought to them in trucks. This makes a comparatively expensive method of handling this fuel but the net result is still in its favor due to the present high prices of oil and coal.

Although the installation of stokers for the handling of hogged fuel does not seem warranted by the added economy to be gained, yet the fact that this fuel may be handled by stokers with equal ease to coal is of the greatest interest in that it is thereby indicated that a quick shift may be made from coal to hogged fuel without any great loss in economy. In the case of the Portland Railway, Light and Power Company, the stokers were supplemented with additional fuel fed from overhead chutes.

ANOTHER SERIES BY BLISS

In the next issue will be found the first article of another series by Professor H. H. Bliss, who will be remembered as the author of the series of articles on "Practical Lessons in Electricity," which were found of such value to men in all branches of the industry. The new series is entitled "Electrical Calculations" and it is intended to fix the ideas taught in the "Practical Lessons in Electricity" by giving practical problems to be solved. The answer to the problems in each article will appear in the one following so that the student will have a chance to work out the problems and get his own solution and answers before seeing how the author has worked out the answer. For those subscribers of the Journal of Electricity who desire to carry on the work in this series and who have not a copy of the "Practical Lessons in Electricity" to help them, a limited number of reprints of Professor Bliss's articles have been made which can be obtained by requesting them from the Journal of Electricity. Look for "RELATIONS IN THE SIMPLE CIRCUIT" in the July 15th issue of the Journal of Electricity.

New Portland Steam Plant

BY E. E. FOOTE

(One of the most interesting of the later installations on the Pacific Coast is that of the Northwestern Electric Company's new steam plant at Portland, Oregon. The electrical features of this plant, which are of unusual interest, have been described by the superintendent of the Portland Station of the Northwestern Electric Company.—The Editor.)

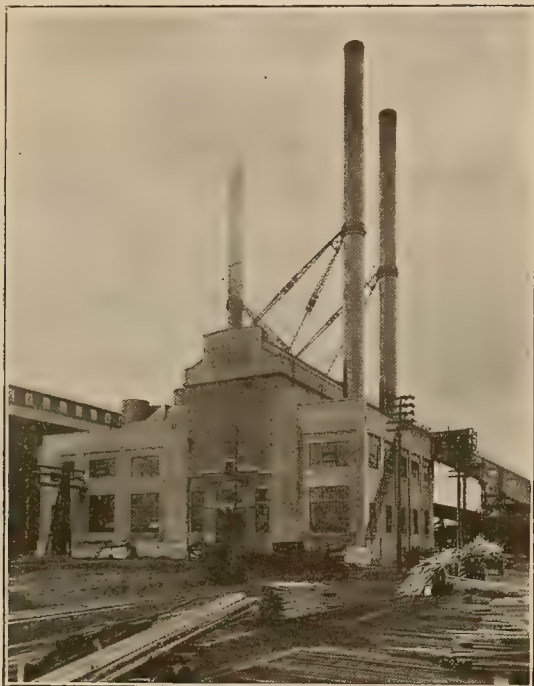
The present tendency toward simplification of generating plant wiring, with a view to obtaining greater ease of control and lessening the maintenance expense, is well exemplified in the new 10,000-

in the Portland district. It is connected to the steam distribution system by a twelve-inch high pressure steam transmission line in addition to its connections with the electrical system.

The station was designed for an ultimate capacity of 30,000 kva. to be developed in steps of 10,000 kva. At the present time one generator has been installed having a rating of 9,375 kva.

As illustrated, the switchboard, exciters, battery charging source, instrument transformers and all disconnecting switches are on the generator floor. This arrangement was made in order to minimize the number of operators required to handle the station, and this arrangement permits the operator to change busses, control the operation of the machine, and keep a close watch over the auxiliary apparatus with a minimum of exertion. The oil switches, storage batteries, station light and power transformers, and main generator field rheostat are located on the balcony. The rheostat is placed near the front of the balcony in order to be in view of the operator.

The switch cells and switches are arranged in three sections of five circuits each designated as the



The new 10,000-kva. steam plant of the Northwestern Electric Company at Portland.

kva. steam plant of the Northwestern Electric Company at Portland, Oregon.

Although the main wiring of the station is of the usual type—consisting of connections from the generator through auto-transformers to the double 11,000-volt bus with oil switches connected to either bus and the lines being taken off the bus in a similar way—the features of most particular interest are those of the synchronizing and control circuits, as shown by accompanying cuts. Of equal importance is the fact that this plant is designed to use saw mill refuse called hogged fuel, with the provision to use fuel oil in emergencies.

Up to the close of 1917 the generating equipment of the company consisted of a 20,000-hp. hydroelectric development on the White Salmon River in Washington and the Pittock station situated in the heart of the business district of Portland, this latter station being a combination of central station steam-heating and electric generating plant. As this plant was committed to the use of oil as fuel, due to its location, it was deemed undesirable, in face of the rising price of oil, to make further additions to this plant.

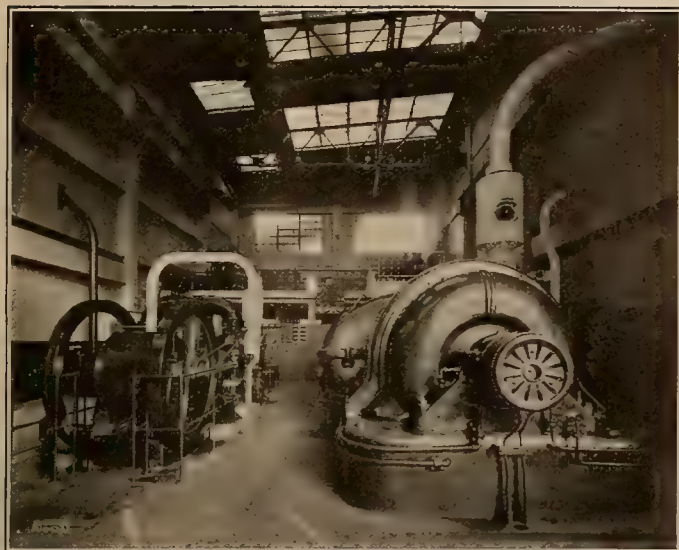
The new plant is situated on the Willamette River and is adjacent to one of the largest saw mills



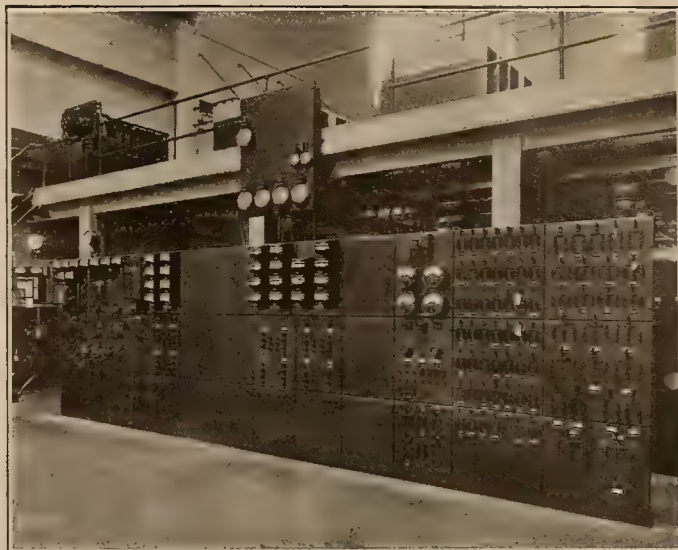
View under switch gallery showing arrangement of bus bars, disconnecting switches, potential transformers and pot heads.

generator section, the tie section and the feeder section.

On the main floor behind the switchboard at the end of each switch section is a terminal board. The instrument and control wires of all of the five circuits of one group terminate at this board, on which are



View looking east in main generator room, showing the switch gallery, steam instrument board and station lighting.



The main switchboard. This is located on the generator floor in order to minimize the number of operators required.

mounted the relays and integrating meters for the group. One unusual detail is that the instrument and control wires leading from the main switchboard control panels to the terminal board may be transferred to any circuit in one of the three sections without the necessity of cutting any wires. This means that a feeder position on the main switchboard can be changed without any difficulty or great expense. Special jumpers are provided on the back of the board which may be removed for meter testing without interference with the wiring.

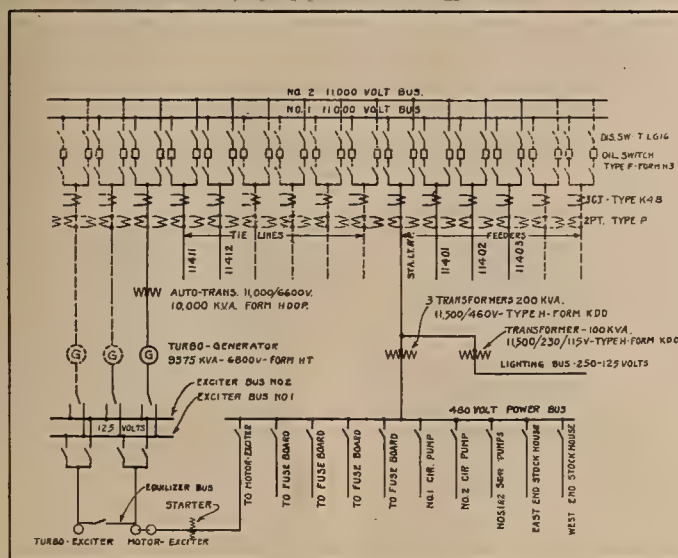
Of the turbine auxiliaries, only the circulating pumps are electrically driven. Two of these are provided for the turbine, one a twenty-inch and one a twenty-four inch pump, which are used alternately depending upon the load on the turbine, the smaller pump being used when the load is less than 6,000 kilowatts.

Cooling water for the bearings and transformers flows by gravity from tanks placed on the roof, to which the water is pumped through an inter-cooler by two and one-half inch centrifugal pumps automatically controlled by float switches. Duplicate float

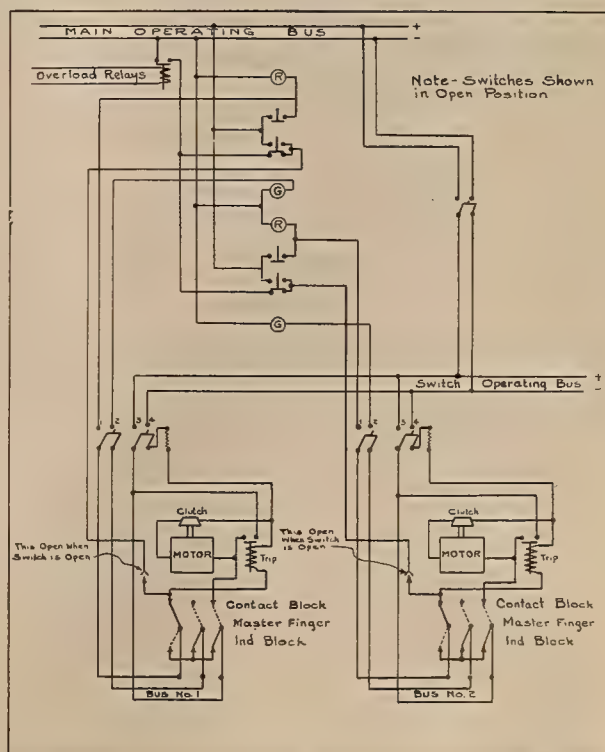
switches are provided in order to prevent damage in the event that one switch fails to act.

The auto-transformers which connect the 6900-volt generator to the 11,000-volt bus have the neutral grounded, thereby stabilizing the voltage of the system with reference to the ground, as this is the only ground on the system. The excitation of the generator is obtained from a compound wound inter-pole, 125-volt generator, driven by a non-condensing Curtis turbine through a reducing gear. An auxiliary exciter driven by an a.c. motor is also provided.

The usual equipment of meters is installed on the 13 panel boards, the equipment of a standard line panel consisting of an indicating wattmeter, a wattless kva. meter, an ammeter, voltmeter, and integrating wattmeters with ratchets for registering input or output.



Single line diagram of electrical connections



Wiring diagram of switch control on the lines and feeders



A. H. Babcock, former vice-president A. I. E. E., chief electrical engineer Southern Pacific Company, San Francisco.



F. G. Baum, former vice-president A. I. E. E., consulting engineer Pacific Gas & Electric Co., San Francisco.



C. A. Copeland, chairman Los Angeles Section, A. I. E. E., electrical engineer Los Angeles Bureau of Power & Light, Los Angeles.



F. G. Cottrell, director A. I. M. & M. E., acting director U. S. Bureau of Mines.

THE WESTERN ENGINEER

FROM Mexico to Canada and from the Golden Gate to Pike's Peak are included some of the greatest extremes in the geography of the country: the highest mountain and the lowest valley; the hottest climate and some of the coldest; the driest deserts and the land of the greatest rainfall. But this whole empire is joined in one common problem; one development of science underlies the entire economic structure—namely, electricity. In this region is the birthplace and the rearing ground of most of the daring ideas in the electrical industry. The world is watching, as it has watched for years, to see what will be the next conception to be brought forth in the West. What will the West do next in the way of huge reservoirs, high dams, long water conduits, or advanced steps in electrical fields? The answers to these questions, which are of the most intense interest to the industries, not only of the West, but to the nation as a whole, lie with the engineers of this section. The engineers and not the commercial men or the financiers, will have to solve these issues.

But the engineers have not neglected their other duties to the state. They are looking about for means to improve civic conditions.

The following brief descriptions outline the history and aims of a few of the most representative engineering organizations of the West. Mention should be made of the many sections and branches of the national engineering societies which take such a great part in this work. These sections and branches deal with the more specialized problems which confront the several engineering branches, and the results of their labors are legion. Engineering organizations other than those noted have a substantial share in the toil, and it is hoped that due recognition may be given to them later. Engineers other than those pictured have had probably as great or greater influence on the progress which has been made. Herewith are only a few of these engineers. These have achieved greatest prominence through the fact that they hold, or have held, important offices in the engineering societies, where they have had opportunity to show their ability.

AFFILIATION OF SPOKANE ENGINEERS

Five and a half years ago at the suggestion of J. B. Fisk, consulting engineer of the Washington Water Power Company and Fellow of the A. I. E. E., the several local chapters of the National Engineering Societies formed a body called Associated Engineers of Spokane. This organization has become a local engineering council or clearing house and embodies exclusively the non-technical activities of the local chapters.

The Association is composed of members of any one of the regular national societies, the only other requirement being payment of annual dues of \$2.00. The executive board of the Associated Engineers is composed of four members from each of the several local engineering societies, each society chapter having an equal voice in Association affairs irrespective of the size of its local membership list.

Some of the work of the Association has been that of helping unemployed members secure posi-

tions; it has helped to secure increased wages for underpaid members; it has kept the hand of fellowship from becoming atrophied; it has secured the appointment of engineer members on local, county or state boards of which engineers should be members; it has assisted in the rescuing of public work from the maladministration of politicians; it discourages the meticulous and exposes the meretricious in public engineering projects; it has assisted in guiding and educating the public in the formation of public policies concerning proposed work where engineering features are involved; it has assisted in educating county commissioners throughout the state in the desirability and economy of employing capable engineers at proper salaries commensurate with the duties, and it protects its members from arbitrary discharge by political officers for whom they may be working.

At the present time the Associated Engineers of Spokane are considering the advisability of creating



W. F. Durand, former vice-president A. S. M. E., professor of mechanical engineering, Stanford University.



E. O. Eastwood, chairman Washington Section A. S. M. E., professor mechanical engineering, University of Washington, Seattle.



J. B. Fisk, president Northwest Electric Light Ass'n, and vice-president A. I. E. E., consulting engineer Washington Water Power Co., Spokane.



C. E. Grunsky, director A. S. C. E., consulting civil engineer, San Francisco.

a new class of members called "Staff" members, to be composed of draftsmen, instrument men, etc., who are too old to be Juniors and who are not qualified to become members of the national societies.

At present the officers of the Association are as follows: L. K. Armstrong, member A. I. M. E., president; A. D. Butler, member Am. Soc. C. E., secretary.

OREGON TECHNICAL COUNCIL

On February 20, 1920, representatives of the American Society of Civil Engineers, American Institute of Electrical Engineers, American Society of Mechanical Engineers, American Institute of Architects, Northwest Association of Highway Engineers and of the National Electric Light Association, met and adopted a constitution for the formation of a society to be known as the Oregon Technical Council.

The purpose of the Council is to coordinate the work of the various scientific technical and engineering organizations, to promote the welfare and professional standing of their members and to foster a more general recognition of the engineer in civic matters.

The Council is to be composed of two representatives from the local Sections of each of the National Engineering Societies as noted above. In addition to this other technical, scientific or engineering organizations may secure membership in the Council by the election of the Council.

As planned at the present time, regular sessions of the Council shall be held once a month at various places for the consideration of matters affecting the

general welfare of the engineers in the territory contiguous to Portland.

THE JOINT COMMITTEE OF LOS ANGELES

BY GEORGE A. DAMON

The Joint Committee of the Technical Societies of Los Angeles is a growing organization of five summers. It measures its age by the mid-year period, for one of the unique features of this association is that it continues its weekly luncheons right through the summer months. The fact that the interest in the Thursday noon meetings continues throughout the whole year is the best evidence of the vitality of the bond which joins the technical men of southern California together in this enterprise.

The formal part of this joint organization consists of a committee composed of the chairman and two appointed members from each of the seven national societies, namely: Am. Chem. Society, A. I. A., A. I. E. E., A. I. M. E., A. S. C. E., A. S. M. E. and A. A. E.

The purpose of this Joint Committee is the consideration of matters of concern common to all of the societies. An annual dinner with an average attendance of about 300 and with eminent speakers is an established custom. The committee endeavors to prevent conflicts in the program of monthly meetings of the member societies, and also frequently arranges joint meetings for the discussion of technical questions of general engineering interest.

The real human, interesting part of the association, however, is the arrangement for a weekly lunch-



H. C. Hoover, president A. I. M. E., consulting mining engineer.



E. C. Hutchinson, president San Francisco Engineers' Club, chief engineer Pelton Water Wheel Co., San Francisco.



E. C. Jones, vice-president A. S. M. E., consulting gas engineer, San Francisco.



L. R. Jorgensen, vice-president A. I. E. E., consulting electrical engineer, San Francisco.



J. A. Lighthipe, former vice-president A. I. E. E., chief electrical engineer Southern California Edison Co., Los Angeles.



C. E. Magnussen, vice-president A. I. E. E., professor electrical engineering University of Washington, Seattle.



C. D. Marx, former president A. S. C. E., professor civil engineering, Stanford University.



L. H. Newbert, president Pacific Coast Section N. E. L. A., commercial manager Pacific Gas & Electric Co., San Francisco.

eon, which is attended by from 30 to 60 men every Thursday noon. Here we have the personal touch and good fellowship of kindred spirits all working together in one common profession. The thirty-minute talks following the luncheon are pages from the personal experiences of active technical workers in different lines and are usually followed by questions and discussion. The societies, in rotation, furnish the chairman and speaker of the day. The programs are not usually announced, as the surprise element is found attractive.

Visiting engineers are given a welcome to our genial gatherings, and men of eminence with a real message are often our guests. But what we appreciate fully as much is to have one of our own fellows tell us some of the difficulties he has recently overcome in connection with his technical duties.

Our members are interested in the building up of this great country with its numerous cities and varied activities. Through the medium of these short personal talks, we endeavor to keep in touch with such enterprises as the development of our public water systems, our hydroelectric systems, our industrial enterprises, our flood control efforts, our harbor plans, our transportation problem, our city plan proposals, our good road improvements, our architectural advancement, our sanitary arrangements and all kindred subjects of education, research, management and even industrial democracy, and the welfare of the engineer. There seems to be no limit to the common interests which draw us together for both information and inspiration.

JOINT COUNCIL OF ENGINEERING SOCIETIES OF SAN FRANCISCO

The Joint Council of the Engineering Societies of San Francisco represents the local sections of the American Society of Mechanical Engineers, the American Society of Civil Engineers, the American Institute of Electrical Engineers, the American Society of Mining Engineers and the American Chemical Society. It was formed for the purpose of furthering the common interests of the members of the engineering profession in San Francisco and vicinity, and for the rendering of public service as opportunity is afforded.

The five Sections of the National Society are represented in the Council by five officers, elected annually, who constitute an executive committee to act for the Council on matters that do not require the action of the entire body. Regular meetings of the full Council are held once a month.

Perhaps the best idea of the purpose of the organization can be given by a statement of some of the matters thus far undertaken. (1) The secretaries of the several local sections have met and agreed upon non-conflicting dates for their separate regular society meetings and have laid out an ambitious schedule of joint meetings to occur quarterly. (2) There is being established an engineer's service bureau which is intended to be a clearing house where employer and applicant can be brought together effectively. This will be a combination and an expansion of the employment bureaus now con-



G. E. Quinan, chairman Seattle Section A. I. E. E., chief electrical engineer, Puget Sound Power & Light Co., Seattle.



E. O. Shreve, president San Francisco Electrical Development League, San Francisco manager General Electric Company.



W. G. Vincent, Jr., chairman San Francisco Section A. I. E. E., valuation engineer Pacific Gas & Electric Co., San Francisco.



C. R. Weymouth, former manager A. S. M. E., chief engineer Chas. C. Moore & Co., San Francisco.

ducted independently by some of the society sections. (3) Joint Council committees have brought about the cooperation of the several sections to the end that labor and clerical expense of the secretaries' offices will be reduced. This by the joint use of addressographs, etc. (4) The Council is coordinating the efforts of the entire membership of the five sections, totaling nearly 1000 engineers resident in central and northern California, in the movement to secure the appointment of an engineer to any vacancy occurring on the state commissions.

Of particular interest is the Service Bureau of the San Francisco Joint Council which is established at the quarters of the Engineers' Club of San Francisco. This service is rendered free, both to engineers seeking employment and to employers seeking the services of engineers.

SAN FRANCISCO ELECTRICAL DEVELOPMENT LEAGUE

Remarkable not only because it has had such a rapid growth, but because it has maintained its identity through the years, is the San Francisco Elec-

trical Development League which at the present time has a membership of approximately 335 men prominent in the industry in the Bay region.

In the spring of 1912 a handful of the leaders in the electrical field in San Francisco gathered together with the determination to form a society which would join with still stronger bonds those who had the well-being of the industry at heart. They thought that there was a fertile field for the development of an organization which would combine in proper proportions not only the more technical phases of the industry but a large share of the activities in which the engineer, the salesman, the manager and the manufacturer should unite to secure the most desirable results in civic affairs as well as general business welfare.

From this beginning the League has reached such a size that it is now the second largest lunch club in San Francisco and has an average attendance of over 150 at its weekly meetings.

The League has taken an active part in supporting electrical affairs of all kinds such as the Co-operative Campaign, the Electrical Home and the various electrical conventions.

Fuel Oil Heaters and Other Accessories

BY ROBERT SIBLEY AND C. H. DELANY

(Fuel oil heaters, oil burners, oil piping, and automatic regulators are factors of prime importance in present day steam electric generation in power plant where oil is used as fuel. The following article, written by the authors of the well-known book on "Fuel Oil and Steam Engineering," should prove of great timely helpfulness throughout the West in those steam electric power plants which are at present oil fired.—The Editor.)

Oil Heaters.—Before reaching the oil burners the oil must be passed through an oil heater to bring it up to a temperature suitable for atomizing. The oil heater is usually placed between the pump and the oil burners, a convenient method being to mount the pumps over the heater, the exhaust steam from the pump being utilized as the heating medium.

Heaters invariably consist of a series of tubes or coils with oil on one side of the metal and steam on the other, the heat passing through the metal from the steam to the oil. There are several different ways in which this may be accomplished; thus the heating surface may be composed of either a coil

or a number of straight tubes; the oil may flow through the tubes with the steam outside, or the oil may surround the tubes with the steam on the inside. All of these methods are used in different heaters now on the market.

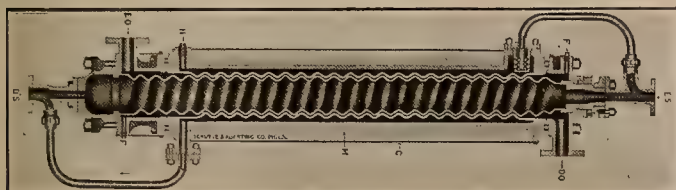
The size of heater is determined by the formula

$$\begin{aligned} \text{where } S &= H K (t_s - t_o) \\ S &= \text{heating surface in square feet} \\ H &= \text{heat absorbed in B.t.u. per hour} \\ K &= \text{coefficient of heat transfer} \\ &= \text{B.t.u. absorbed per hour per square foot per} \\ &\quad \text{degree difference in temperature} \\ t_s &= \text{mean temperature of steam, Deg. F.} \\ t_o &= \text{mean temperature of oil, Deg. F.} \end{aligned}$$

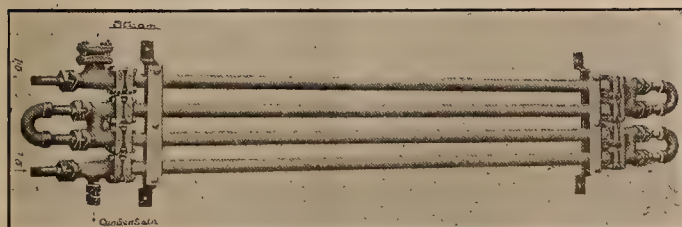
The quantity H , heat absorbed per hour, is found readily by the formula

$$\begin{aligned} \text{Where } H &= W (t_2 - t_1) c \\ H &= \text{weight of oil heated per hour in pounds} \\ t_1 &= \text{initial temperature of oil, degree F.} \\ t_2 &= \text{final temperature of oil, degrees F.} \\ c &= \text{specific heat of oil, } = 0.498. \end{aligned}$$

The quantity K , coefficient of heat transfer, varies with the difference in temperature between the steam and the oil, and with the velocity of oil in passing through or around the tubes. This velocity is of great importance, as the greater the velocity the better is the oil scraped from the side of the tube, thus allowing the colder oil to come in contact with the hot surface. It is evident, therefore, that a high velocity of oil is desirable. There is a limit, however, to the velocity attainable, as the higher the velocity the greater is the drop in pressure of the oil in passing through the heater. The drop in



The Schutte and Koerting fuel oil heater



The "Coen" multiunit oil heater

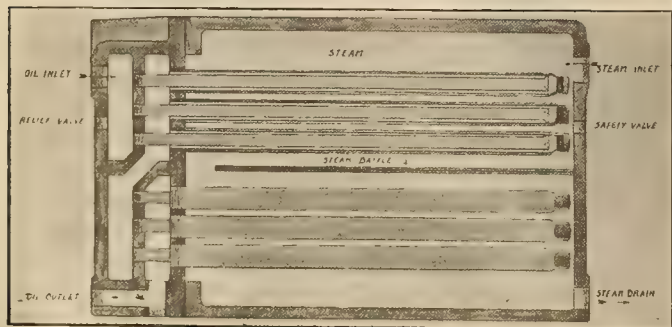
pressure in turn depends largely on the viscosity of the oil, so that viscosity has an important bearing on the heat transfer. The value of the coefficient, K , therefore varies between wide limits and for ordinary conditions may be said to lie between 15 and 50 B.t.u. per hour per square foot per degree difference in temperature.

For a heater in which the oil flows through the tubes it is a simple matter to divide the flow into passes so as to obtain the required velocity, the oil passing through first one group of tubes and then another. If the heater is designed to contain the oil in a shell outside the tubes, there is a tendency for the oil to short circuit across from the inlet to the outlet, leaving portions of the heating surface surrounded by dead or stagnant oil. To overcome this it is necessary to place baffles in the shell causing the oil to travel back and forth, and producing what is known as turbulent flow. If the baffles are properly designed, and the oil flow is sufficiently agitated it is possible to obtain as good heat transfer for a given drop in pressure by this means as by passing the oil through the tubes.

While oil heaters usually consist of a shell containing a series of tubes or coils, there are on the market a few special designs. One of these is the Coen multiunit oil heater, which is illustrated in this article. This heater is similar in design to the ordinary ammonia condenser used in ice machines, and consists of a series of double pipes, one inside the other, connected together by standard ammonia fittings. This heater may be constructed in any length or number of legs as desired. The oil passes through the inside pipe, and the steam is in the annular space between the two pipes.

Another heater of unusual design is the Schutte and Koerting fuel oil heater, shown in an accompanying illustration. This heater consists of a pair of spiral corrugated tubes, one inside the other, and both inclosed in a shell. The oil enters at E O and passes up the thin annular space, leaving at D O. The steam enters at E S, and is carried both inside the inner tube and outside the outer tube. For cleaning, the inner tube may be removed, or steam blown through the plugged openings F F.

Oil Burners.—After leaving the heater the oil is led through piping and suitable regulating valves to the oil burners or atomizers, where it comes in contact with the atomizing agent and is delivered to the furnace in the form of a fine spray.

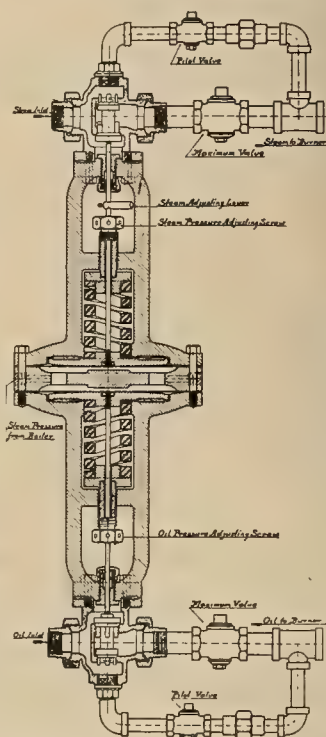


Nelson multi-pass film type porcupine oil heater, sectional view. This is a multi-pass heater using the principle of "porcupine" tubes, the tubes being free at one end for expansion and contraction.

Oil Piping.—Ordinary wrought iron or steel pipe is used for oil, the smaller sizes being screwed and the larger flanged. Gaskets of corrugated copper or compressed asbestos fibre are used. The size of pipe in most power plants is such as to give the oil a velocity of not more than 2 feet per second.

Automatic Regulators.—While in the majority of plants the oil is regulated by means of hand op-

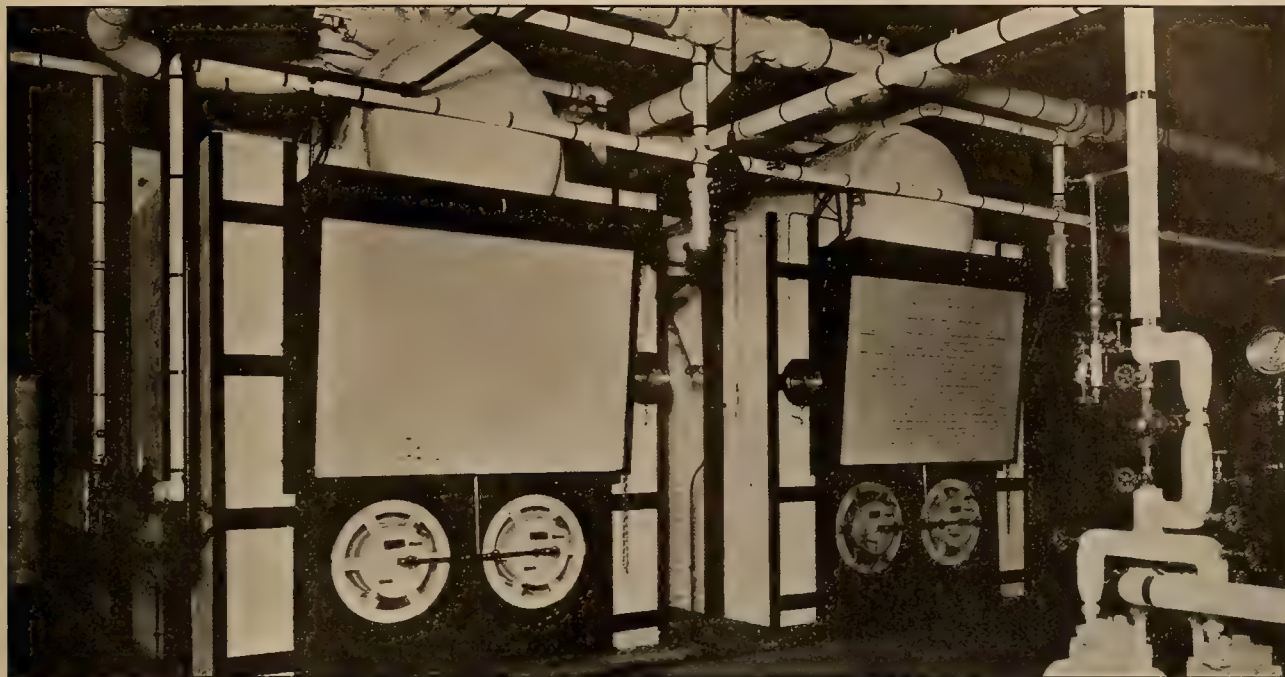
erated valves, automatic regulation has met with great success and is used quite extensively. The Witt Improved Oil Burner Governor consists of two independent diaphragm operated valves, controlled by springs, mounted so as to have the boiler steam pressure between the two diaphragms. This governor regulates both the oil supply and the steam supply to the burners. It is provided with pilot valves which prevent the fire going out when the load is light, and with maximum valves which prevent the fires becoming larger than a predetermined point. The governor, therefore, regulates the oil and steam between these two extremes.



G. E. Witt Co.'s Improved Oil Burner Governor. A device for automatically controlling the flow of steam and oil to burners.

The Moore Automatic Fuel Oil Regulator regulates not only the oil and steam but also the air required for combustion, thus controlling the three essential elements for firing the boiler. This apparatus consists of three separate regulators, one for the oil, one for the atomizing steam, and one for the air. These regulators are made up on the principle of the well known Spencer damper regulator, and the set of three can be arranged by suitable piping and shafting to control the firing of a number of boilers, and in many cases of the whole plant. In the oil regulator the diaphragm is operated by the boiler steam pressure, and the power lever is used to control a regulating valve in the main oil pipe supplying the burners. By this means a slight change in the boiler pressure is made to cause considerable change in the oil pressure, and as the quantity of oil supplied to the burners varies with the oil pressure, the fires in all boilers are increased or diminished gradually and simultaneously. This variable oil pressure is then made to act on the diaphragms of the other two regulators.

In the atomizing steam regulator, there are two diaphragms, one acted on by the controlling oil pressure and the other connected to the atomizing steam pressure near the burners. These diaphragms are connected by levers which, acting through the water motor and connecting rod, operate a chronometer



TWO 250-HP. HEINE BOILERS WITH MECHANICAL BURNERS

Standard equipment at eleven pumping stations—Shell Company of California Oil Pipe Line—installed by Sanderson & Porter. Duplicate duplex oil pumps in lower right hand corner are controlled by pump governor in steam supply line to produce constant oil pressure in receiver. Pump governor in oil discharge line from pump may also be seen just below oil gage and controls oil discharge to produce constant steam pressure because pressure side of its diaphragm is connected to steam line. Oil line from pump crosses overhead and descends to oil heater located on side of boiler setting in lower left hand corner, thence oil pipe runs direct to burners. Oil heater is supplied from auxiliary steam main through pump governor set maintaining constant pressure and hence constant temperature. Operation is entirely automatic, oil being supplied to the burners under control of the pump governors so as to maintain constant pressure.

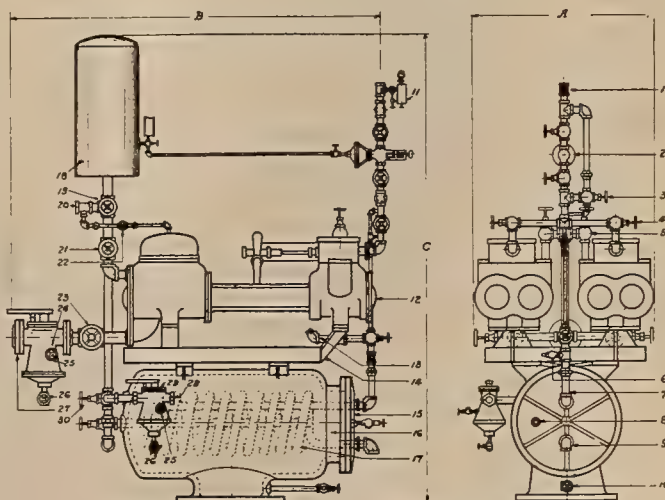
valve in the atomizing steam main. Thus any increase in oil pressure causes a definite fixed increase in atomizing steam pressure. The steam pressure required has been found by experiment to be a multiple of the oil pressure plus a fixed pressure. This relationship is maintained by the regulator, the proportion being varied by the adjustable fulcrum and weights to suit the requirements of the type of burner employed.

The air is controlled by the third regulator which operates a rocker shaft connected to the dampers of all boilers. In this regulator the motion caused by the diaphragm, which is acted on by the oil pressure, is resisted by a coil spring. The amount of movement of the lever is therefore proportional to the oil pressure. This movement is communicated by means of a controlling valve and differential lever to a hydraulic cylinder, which in turn operates the rocker shaft connected to the dampers.

The Merit Automatic Oil Stoking System operates on the principle of controlling the fires in a series of steps, the fire jumping from a small fire to an intermediate fire and then to the maximum fire. The oil, atomizing steam and air are all three controlled by this regulator. The boiler steam pressure acts on the diaphragms of the master controller set, which consists of two parts, one for the maximum fire and one for the medium fire.

Each of these is piped to a damper operating device, and to a regulating device on each burner, which operates both the steam and the oil valve to the burner. For convenience fuel oil from the main oil supply pipe is used as the operating fluid, returning to the oil pump suction when used. If the boilers have full steam pressure up they will be working on

the small fire. If the steam pressure begins to drop the first master controller diaphragm comes into play, opening the dampers to their medium position, and opening the intermediate oil and steam valves to each burner. These valves are always either open or shut, the amount of opening being fixed by adjustable auxiliary valves. If the steam pressure contin-



Staples and Pfeiffer oil pump and heater unit

ues to drop, the second master controller comes into play opening the damper to its full open position, and opening the remaining oil and steam valves to each burner, thus placing the maximum fire in operation. This condition will continue until the steam pressure rises sufficiently to shut off the maximum fire, when the boilers will return to the intermediate fire, and the operation will be repeated.

Steam Turbine Characteristics

BY WILLIS T. BATCHELLER

(This interesting series on the theory of the various types of steam turbines was temporarily discontinued after April first on account of the press of material in the convention issues. Following is the fourth article of the group. The author is electrical engineer with the Seattle Lighting Department, and is exceptionally well qualified to present the subject.—The Editor.)

THE REACTION TURBINE

In the reaction turbine the steam passes through a set of stationary guide vanes which direct the steam against the rotating blades. The drop in pressure is practically uniform through the stationary and rotating blades. Steam expands in the first row of stationary blades and accelerates the jet to practically the velocity of the moving blades. The steam enters the adjacent row of rotating blades with only a small impulse, and expands through this row, producing rotation by the reaction of the steam on the blades. The distinctive feature about the reaction turbine is that the drop of pressure and corresponding increase in velocity occurs in the rotating element.

Theoretically the area of the steam cylinder passages between the spindle and the cylinder should gradually increase from the high pressure to the low pressure end, but in practice the stages are made in three subdivisions and the length of blades in each stage is increased to take care of the increased volume of the steam. In the single flow reaction turbine, the end thrust, due to the difference in steam pressures at each end of the drum, is equalized by means of balancing pistons mounted on the rotor near the high pressure blading. Some turbines are constructed with the steam entering at the center of the rotor and flowing both ways to equalize the thrust. Provision for carrying overload is made by providing an auxiliary by-pass valve which admits high pressure steam to the intermediate stage of the turbine, resulting in slightly poorer economy. The Parsons reaction turbine is the best known type, and is manufactured by the Allis-Chalmers Manufacturing Company and by the Westinghouse Electric & Manufacturing Company.

Reaction Turbine Theory

A reaction turbine operating under the steam conditions specified for the nine stage impulse machine would have about forty-seven stages. With the same total heat drop of 380.5 B.t.u., the heat

drop per stage is $\frac{380.5}{47} = 8.1$ B.t.u. per pound of steam.

The velocity of the steam entering the first set of stationary blades is assumed to be zero and the velocity imparted to the steam is

$$V_1 = 224 \sqrt{\frac{8.1}{2}} \\ = 451 \text{ ft. per sec.}$$

Since the entrance velocity is zero this also represents the spouting velocity.

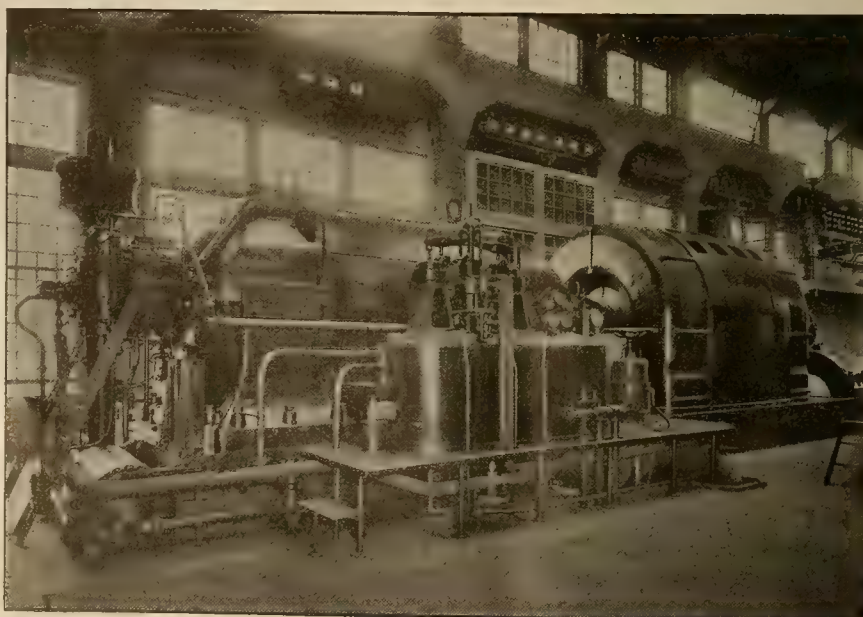
With a peripheral velocity of 300 feet per second, and an exit angle of 50 degrees, the relative velocity of V_1 of the steam entering the moving blades is found to be 242 ft. per sec. The energy given up by expansion in the moving blades is

$$E = 778 \times \frac{8.1}{2} = 3151 \text{ ft. pounds per second.}$$

This energy is imparted to the steam in the first set of moving blades, where

$$E_2 = \frac{V_2^2 - V_1^2}{2g} \\ 3151 = \frac{V_2^2 - 242^2}{64.4} \\ V_2^2 = 144,360 \\ V_2 = 380 \text{ ft. per sec.}$$

10,000-kw. Westinghouse reaction turbine at the steam plant of the Great Western Power Company at Beach and Mason streets, San Francisco. This is one of the large modern installations on the Pacific Coast.



The resultant of V_2 , the relative velocity of the steam leaving the moving blades and U , the peripheral velocity of the wheel, is 192 feet per second, V_2 .

The energy converted into work in the first stage is

$$E = (V_1^2 + V_2^2 - v_1^2 - v_2^2) \frac{1}{64.4}$$

$$= (451^2 + 380^2 - 242^2 - 192^2) \frac{1}{64.4}$$

$$= \frac{252,873}{64.4}$$

$$= 3920 \text{ foot-pounds per second or about seven horsepower for each pound of steam flowing through the ideal turbine.}$$

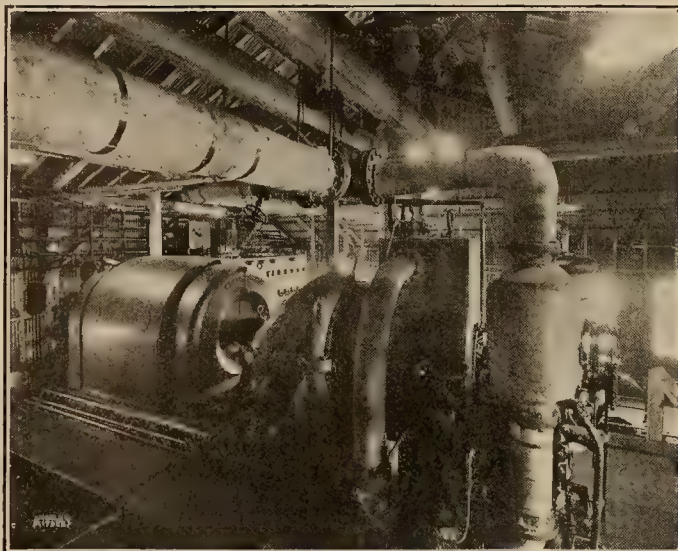
Combined Impulse and Reaction Turbine

In the combined impulse and reaction turbine the smallest barrel of reaction blading is replaced by an impulse wheel. Steam enters through the nozzles and is discharged against a portion of the periphery of the impulse wheel. After leaving this wheel the steam enters the reaction blading through which it passes in the same manner as in a pure reaction machine. The advantage of this arrangement is that the high pressure, high temperature steam is confined to the nozzle chamber of the impulse element. The Westinghouse Company uses this design in the larger sizes of turbines.

Compound Steam Turbines

In the high pressure stages of a Parsons turbine where the steam density is high, the steam area is relatively small, resulting in a small diameter rotor which must operate at high speed in order to have the best velocity ratio conducive to high economy. On the other hand, the rotative speed of the turbine is limited by the centrifugal stresses which

of the low pressure cylinder. In this way the centrifugal stresses in the low pressure cylinder are kept within a safe working limit. Two-cylinder turbines are arranged tandem or cross compound. Three-cylinder cross compound units have a high pressure element consisting of a single cylinder, single-flow reaction turbine and two low pressure



1500-kw. Westinghouse Parsons reaction turbine of latest design, in power house of Crossett Western Lumber Company at Wauna, Oregon.

elements consisting of turbines of the double-flow type.

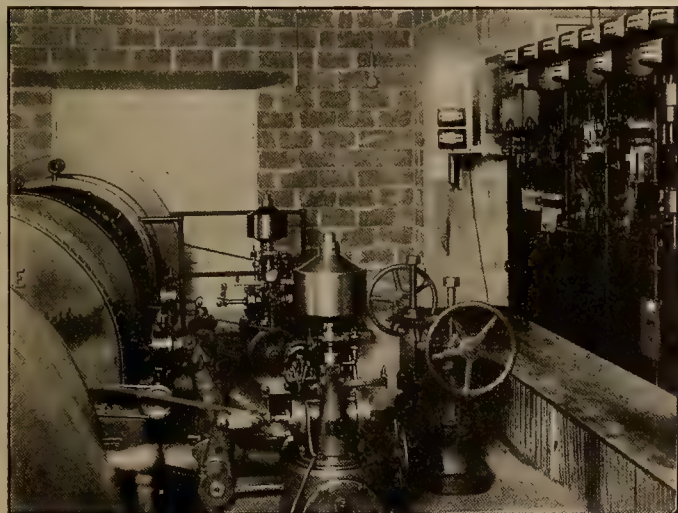
Multi-cylinder construction has the advantage over a single cylinder machine of the same capacity, having smaller cylinders, lower temperature range per cylinder, highest efficiency for each cylinder for the range of expansion involved, and reduced weight of parts to be handled. In case of emergency, any of the cylinders can be operated alone.

SOUTH AMERICAN RAILWAY ELECTRIFICATION

The Paulista Railway electrification in Brazil is one of the largest electrical projects now being pushed on that continent. This electrification will have an initial installation of 28 miles of track, but later extensions are to be made which will make a total of over 100 miles additional. The International Westinghouse Company has recently contracted to furnish four locomotives, two each for passenger and freight service.

The passenger locomotives have a one hour rating of 2000 hp. and weigh 121 tons. They will be operated from a 3000-volt, d.c. overhead trolley system and will be complete with regenerative control. They are designed for a maximum speed of 65 miles per hour and have a track gauge of 5 ft. 3 in. The freight locomotives have a one hour rating of 1500 hp. and will weigh 87 tons. They are also operated from a 3000-volt, d.c. overhead trolley system and will be complete with regenerative control. Their maximum speed will be 40 miles per hour.

In the regenerative braking system great care has been exercised so to perfect the design that there will be no likelihood of accidents due to the trains getting out of control on steep down grades.



1875-kva., 80 per cent power factor, 480 volts, 3-phase, 60 cycles, 3600-r.p.m. with 15-kw. direct connected exciter. Geared turbine drives discharge pump of low level jet condenser.

occur at the exhaust end of the rotor where the blade area is largest to provide for the large volume of steam at exhaust pressure. In order to have both high and low pressure stages of large turbines operate at highest economy, the Westinghouse Company builds the multi-cylinder type, with the high pressure cylinder operating at about twice the speed



The great fertility of this region in Idaho is largely dependent upon electricity, which by facilitating irrigation and other agricultural operations has contributed immeasurably to the development and prosperity of the district.

Developing Idaho by Water Power

(The more intimate knowledge all those of any one particular industry have of the parts more remote, the better fitted they are to carry on their own work. The following article, which describes in an interesting way the system of the Idaho Power Company, shows the progress in that fertile section of the West. This company has sufficient hydroelectric power to meet all needs for industrial and agricultural power for years to come.—The Editor.)

Operating throughout an extensive territory in southern and central Idaho, and in a section of eastern Oregon, the Idaho Power Company is not only playing an important part in the development of this rich and growing section of the country, but is itself, because of its strategic location both as to source of power and to a growing market, undergoing an unusual growth.

Electrical Development of Natural Resources

The Snake River district, which is served with electric power and light by this company, is an extensive, prosperous and steadily growing territory, rich in agricultural, mining and timber resources, and comprises the most populous part of Idaho. More than sixty communities are supplied with electric service by this company, including Boise, the state capital, Pocatello, the second largest city, and twelve county seats. The total population served is estimated at 150,000, based on the more than 30,000 names on the company's books.

In addition to furnishing current for lighting and miscellaneous uses in these communities, the company has important contracts for the sale of large amounts of power. Land development by the means of irrigation projects is one of the most important undertakings in the territory, so that the Idaho Power Company is called upon to furnish power for pumping water for irrigation purposes, in large and steadily increasing amounts. During the season of 1919, it supplied this essential service for the irrigation of 88,659 acres of land. In addition, it furnished power for the principal mining districts in the territory in which it operates, including Silver City, Mormon Basin, Corucopia, and Homestead.

Hydroelectric Developments

The Snake River with its tributaries is the

source of power utilized by the company's twelve generating plants, for the river falls nearly 2500 feet in its 400 miles of winding course between the upper and lower plants. Advantage has been taken of this fall for the construction of seven hydroelectric developments at various points on the river, extending from southeastern Idaho to eastern Oregon. The eighth is at Thousand Springs, the waters of which flow into the Snake River. Two additional plants are located on the Malad and Payette rivers, both of which are tributaries of the Snake. The company also operates, under leases, two other hydroelectric plants. One of these, the property of the Boise Irrigation Project, was installed by the Federal Reclamation Service in connection with the construction of Arrowrock Dam.

The plants owned by the company have an aggregate installed generating capacity of 33,540 kw. and those leased an aggregate of 2,775 kw., making a total capacity of 36,315 kw. operated. An additional capacity of 6,000 kw. has been added to the plant at Thousand Springs, in order to be available for use during the summer of 1920. The immense supply of water power not yet developed still leaves room for almost unlimited growth, and makes it quite certain that the company will never have to depend on coal supply to keep up with its growing market for power.

Interconnected Plants

All of the generating plants, excepting the American Falls plants operated by the company, are interconnected by a comprehensive system of transmission lines and are operated in one group. This interconnected system supplies all the electric power and light of the company except that used in the territory in and about Pocatello, American Falls and Blackfoot.

The plants supplying this vicinity are connected with the transmission system of the Utah Power & Light Company; so that every point covered by the operations of the Idaho organization is practically guaranteed continuous service, no matter what happens. As conditions justify, the two groups will be connected and the entire property will be operated



Mill of the Homestead Iron Dykes Mining Company electrically operated with power supplied through the Idaho Power Company

as a single system. The company's transmission lines aggregate 1,139 miles, including the line to the

Jarbridge mining section, which supplies the Nevada Power Company.

Street Railways

A street railway system in Boise, and an inter-urban railway connecting Boise with Nampa, Caldwell, Middleton and other towns are owned and operated by the Boise Valley Traction Company, a subsidiary organization. Its interurban lines total seventy miles of single track equivalent, while the city lines total approximately 13 miles. Electrical power for the operation of these lines is purchased from the Idaho Power Company. The Nevada Power Company supplies electricity to the Jarbridge mining section in northern Nevada. The electric sub-station of the Nevada company is supplied by a 66,000-volt transmission line, 71 miles in length, from the system of the Idaho Power Company.

Since the company was incorporated in 1915, its growth has been phenomenal, while its prospects for rapid and steady development in the future are more than assured. The immense and fertile territory covered by its operations is just in the period of greatest development. Every year the acreage under agricultural cultivation is greatly increased, old manufacturing and industrial plants are growing, while new ones are constantly springing up. The population is mounting by leaps and bounds. All these things, together with the assurance of almost unlimited water power, promise a great future for this Idaho company.

The Man in the Company

BY A. B. WOLLABER

(The broader relation of the employee to his work and to his company has a very definite influence, not only upon his own immediate advancement but upon his ultimate development as a worker. Some of the aspects of the work of various employes in a public utility company are taken up in the following article. The author is district manager with the Southern California Edison Company.—The Editor.)

It is sometimes remarked that few if any of the chief clerks in this or that company ever become local managers, and it has often occurred to me that the chief clerk is, or at least should be, the one best qualified to fill the responsible position of local representative.

The Chief Clerk

Of chief clerks I would ask the question, what are you doing to qualify yourself for the position higher up? What is there in your work that marks you as a safe man—one that the management can look to as a corner stone for the district organization? Are you making the most of every opportunity to learn more about the business in which you are engaged by good, hard, conscientious study? Do you take an interest in and carefully read the many splendid articles which come to you through the excellent publications so generously furnished by the company? What have you done to inform yourself of the relation your company bears to the community in which you are doing business, and what its relation is to the various city officials? Are you thoroughly posted on your company's policies so far as they concern your individual district, its methods of

financing and rate making, and are you capable of conversing intelligently on these subjects? Are you familiarizing yourself with what other utility companies are accomplishing in the business world? Are you making the best of every opportunity given you to show your fitness for a higher position by doing your work just a little bit better than that particular job was ever done before? It is well occasionally to pin yourself up on the wall, so to speak, and look yourself over and then ask this question, "What have I done to merit consideration for work of a higher intellectual character with my company?" Upon your answer to this question, if made without self-pity, egotism or malice, will depend your success in any organization with which you are identified. Remember this, you will take out of your work just what you put into it.

The District Foreman

Outside of the district office there is no more important position than that of the district foreman. Upon him depends the continuity of service, and it largely rests with him as to what impression the community gets of your service. His forces are constantly in touch with the public, and the question

to be asked is, are these impressions always the best? Are you careful with your work and are you as quick to commend those under you for good work as you are to condemn them for poor? Are you doing everything in your power to advance your forces to higher positions with the company, and are you big and broad enough to recommend for a foreman's position one of your assistants, even though you may find it difficult to fill his place? Are you in the habit of taking your men into your confidence and explaining to them in a general way the conditions under which the company is operating in your particular district, with a view toward encouraging them to better efforts and more economical operation? Are you careful to see that the equipment furnished your forces is the best, and up to the standard desired by the company? Are you careful to see that those under you are provided with literature pertaining to the electrical industry? Are you careful at all times to make your work and the surroundings of your fellow workers the pleasantest possible in order that they may be loyal, satisfied and efficient employees of the company? Briefly, these are a few of the things that the district foreman can do towards securing better service, and a better profit to those working under him. The result will be a gain for your company as well as yourself, and an incentive for those willing workers in the ranks who are always ready to keep the old ship moving in order that the impressions of the public may be the very best.

Other Employees

In the last class we have placed the other district employees, and our remarks to these must be more or less general but applicable to all. The counterman, meter readers and collectors are the ones who also come in contact with the consumer, and to them a great opportunity is given to learn, because a thorough knowledge of human nature is a great asset in the administration of any business. I am going to ask the employees in this class what they are doing to merit advancement to higher positions. Are you ever alert to safeguard your company and the official under whom you are working from dangerous conditions? It may be only a slight remark dropped at the counter, to the meter man or to a collector, but this remark oftentimes furnishes a clue to a situation that might prove disastrous to your company. If you adopt an "I should worry" attitude, where will your profit come from? It may be that your failure to watch and listen and then report to your superiors, is the very thing that will contribute to the loss of business, or to the establishment of another company in your community. Are you familiar with the rates your company charges for its commodity, and are you capable of quoting these rates and discussing them with the company's consumers? How often we hear the man at the counter say, when asked regarding power or rates, "I will take your order and our salesman will call on you." The rates of the company are not complicated and they are open to the inspection of all. Those inside the office are quite as capable of analyzing them as are the regular employees assigned to that kind of

work. By taking an interest in such matters you gain in knowledge and enhance your value to your company and to the community you serve; then when the time comes to fill one of the higher positions you are well equipped for the job, and you have gained the profit.

Consistent Ambition

Each and every employe in the company, bookkeepers, meter readers, collectors, on-and-off men, and so forth, should be alert and anxious to take advantage of every detail which will increase their value to their company, by studying the job just ahead, by punctuality, application to duty, alertness, accuracy and above all, honesty. If you are satisfied with the position of bookkeeper, counterman or any of the other positions mentioned in this class, you are wasting your time. For without ambition to rise in any business, what incentive is there for good work? Do not be surprised if you fail to take from your work a just reward for such indifference, and find yourself rising no higher than the position you now occupy.

The following extract from a report recently issued by a special committee of the New York Merchants' Association on Government Ownership and Operation of Public Utilities is representative of what all large business concerns are striving for in their relation to their employes. It says:

"The success of any economic undertaking depends in very large degree upon the ability and skill, the zeal and energy, and the soundness of judgment of the human agents employed therein. Ability and skill in a particular field are the products of special and usually prolonged training; by far the most powerful motive of zeal and energy in the ordinary affairs of the world is self-interest as understood in its widest meaning; and intimate knowledge derived from experience is essential to sound judgment in business affairs. Every large business concern seeks to embody in its management and working organization intimate knowledge, long experience, sound judgment, special ability and skill, zeal and energy. Having secured these qualities it seeks to retain and expand them by making the self-interest and ambition of officials and employes a dominant motive for loyal devotion to the welfare of the business. The motive of self-interest and ambition is brought into play by the free opportunity of advancement always open to special ability and zeal, and by the assurance of permanent tenure to those who are efficient."

In closing let me say to all that the employes of any organization should never forget that they are competitors, not merely units in a great machine. Keep this thought ever before you and know that you will get a just reward for the labor you put forth.

SAFETY

Human life must be made safe. Property must be protected. Electrical methods invariably reduce hazards.

The application of electricity, with modern developments in insulation and safety appliances, will eliminate accidents and conserve property.

Ease of control is one of electricity's greatest advantages. Magnetic switches, relays and automatic devices of infinite variety reduce the operation of terrific forces to the simplicity of the push button.

Education to the merits of quality wiring and quality apparatus will maintain the high standards of industry.

California Precipitation

BY ANDREW H. PALMER

(The importance of the water supply in California makes precipitation figures for this region of more than usual interest. The following article, of which the first part appeared in the June 15th issue, reviews the snowfall in the mountain districts, with special emphasis on the headwaters of the important streams. The author is meteorologist with the U. S. Weather Bureau.—The Editor.)

The Weather Bureau maintains a considerable number of elevated stations in the Sierra Nevada Mountains where careful measurements of precipitation, especially snowfall, are made. The highest of these stations is 8,390 feet above sea level. The records are of various lengths, those at stations along the Overland Route of the Southern Pacific Railroad now covering 43 years. Data from these stations are of great value to engineers in estimating water for hydroelectric power and irrigation.

Snowfall in the Mountains

Snowfall data for a number of stations are summarized in Tables III and IV. The marked deficiency of snowfall during the present season, and particularly during January and February, is readily apparent. While considerable snow fell during March, a word of caution is appropriate in this connection. Under normal conditions abundant snow falls during the midwinter months, and it packs through pressure resulting from weight and also through alternate freezing and thawing. As snow falls it is ordinarily 10 per cent water, by volume. In other words, 10 inches of newly fallen snow is usually equivalent to one inch of rain. Moreover, during a normal season the snow comes in well distributed installments, and in the spring it is densely packed in layers, some of which have the consistency of ice. Extensive measurements of the water content of snow on the ground made in spring snow surveys by Professor J. E. Church, Jr., of the University of Nevada, and by representatives of the Weather Bu-

reau, have shown that packed snow lying on the ground averages about 40 per cent water, by volume. Since the snow of the present season has not packed to any considerable extent, the lately fallen snow is light, and contains less water than similar depths of former years. It will disappear rapidly, either through melting or as a result of dessicating, northerly winds. There is little of the packed snow which can be expected to furnish an ample water supply through slow melting in the coming summer. The light density of the snow on the ground should be borne in mind in examining the accompanying curves showing the depth of the snow on the ground at Summit.

Run-Off Data

Because of the fact that this is the fourth consecutive season with deficient precipitation in California, the cumulative effects of deficient precipitation are evident in the stages and discharges of streams. The rocks have retained relatively little moisture, ground water has receded to extremely low levels, and the soil has remained relatively dry. A peculiar phenomenon has made this condition impressive. The stage of the Sacramento River has been so low recently that the salt water of San Francisco Bay has encroached upon the lands of the delta region, seriously threatening the fertility of that vast territory. Irreparable harm and permanent damage may result if the threatened condition becomes acute.

In Table V are summarized discharge data of

Table III
SNOWFALL IN INCHES

Normals—upper figures
Season of 1919-20—lower figures

STATION	COUNTY	ALT. (Feet)	SEPT.	OCT.	NOV.	DEC.	JAN.	FEB.	MAR.	APR.	MAY	JUNE	SEASON
Bishop Creek...	Inyo.....	8390	..	8	10	28	52	38	27	12	10	1	186
Blue Canon...	Placer.....	4695	..	3	9	29	54	46	54	12	4	..	211
Emigrant Gap...	Placer.....	5230	..	3	6	62	4	25	84	18	..	..	278
Fordyce Dam...	Nevada.....	6500	2	13	33	53	98	76	86	26	14	1	402
Inskip.....	Butte.....	4975	..	2	7	41	78	50	48	10	5	..	241
Lake Eleanor...	Tuolumne.....	4700	..	1	7	49	4	39	86	20	..	..	158
Lake Spaulding	Nevada.....	4600	..	4	10	54	58	46	67	13	3	..	255
La Porte.....	Plumas.....	5000	..	3	8	48	7	20	82	34	..	..	273
McCloud.....	Siskiyou.....	3270	..	6	15	37	63	51	61	29	10	1	126
Quincy.....	Plumas.....	3400	..	2	8	60	2	32	70	..	..	..	77
Sierraville.....	Sierra.....	5000	..	4	29	62	13	16	2	..	..	..	107
Sisson.....	Siskiyou.....	3555	..	3	33	0	4	6	12	..	..	..	112
Squirrel Inn...	San Bernardino	5280	..	1	3	10	29	13	20	1	..	..	59
Summit.....	Placer.....	7017	2	18	34	72	79	76	47	56	20	2	406
Tamarack.....	Alpine.....	8000	3	14	53	95	187	77	96	26	29	7	587
Yosemite.....	Mariposa.....	3960	4	11	30	84	24	60	96	47	..	..	105
			..	..	4	17	39	21	20	4	..	..
			..	..	0	36	0	18	40	6	..	..

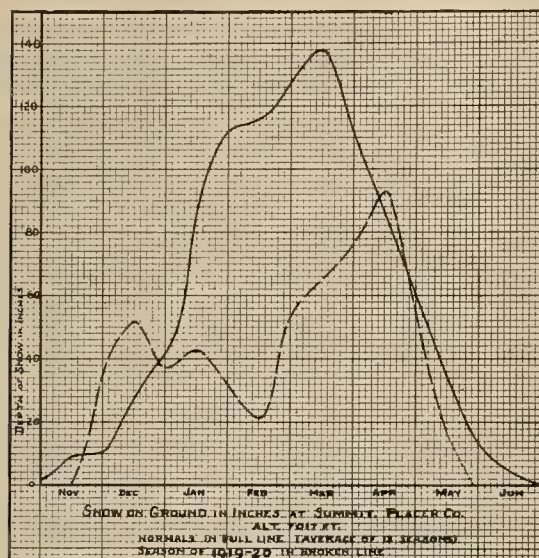
Table IV
SNOW-ON GROUND IN INCHES

Normals—upper figures
Season of 1919-20—lower figures

Date	Fordyce Dam Nevada Co. Alt. 6500 Ft.	Summit Placer Co. Alt. 7017 Ft.	Tamarack Alpine Co. Alt. 8000 Ft.
November 1	1	1	1
November 15	0	0	0
December 1	8	9	11
December 15	0	0	0
January 1	9	10	17
January 15	18	34	36
February 1	28	28	38
February 15	50	52	48
March 1	38	41	57
March 15	34	37	28
April 1	71	87	101
April 15	33	43	23
May 1	83	112	139
May 15	34	32	21
June 1	92	116	149
June 15	30	21	27
July 1	112	128	173
July 15	54	53	60
August 1	109	138	177
August 15	58	65	56
September 1	103	114	167
September 15	67	76	86
October 1	87	87	135
October 15	74	93	90
November 1	68	60	115
November 15	50	55	72
December 1	50	34	95
December 15	16	14	65
January 1	29	14	65

some of the principal California streams. These data have been kindly furnished by the Water Resources Branch of the U. S. Geological Survey.

The present rainy season has brought deficient precipitation to all the Pacific Coast states. The months of December, January and February were relatively dry in the states of Nevada, Oregon and Washington, as well as in California. In Oregon,



Mass curves of precipitation for the state of California based on averages from about 300 stations. The heavy line represents the normal, and the dotted line the precipitation for the season 1919-1920.

January and February, 1920, were the driest months of those names in 30 years of record.

A peculiar feature of the weather during the present season is the fact that there has been an apparent northward migration of the usual conditions affecting the weather of the Pacific Coast. Storms entering the continent of North America from the Pacific Ocean have taken northern routes, so far to the north that California has been outside of the range of precipitation for most of them. Moreover, extreme southern California has had relatively heavy precipitation from storms of the sonora type. The rainfall has been sufficiently heavy in Arizona and in New Mexico to cause floods.

The question is often asked, "Is the climate changing?" The idea is expressed in various ways. Some say that the removal of the forests and the increasing cultivation of the interior valleys have affected the climate of California. Others say that the great earthquake of 1906 changed the course of the Japan Current. However, there is no evidence in the longer records, some of which now cover 70 years, that the climate is changing or has changed recently. There is no progressive change indicated. To the question the Weather Bureau therefore answers emphatically, "No, the climate is not changing."

All available data point to the inevitable conclusion that northern and central California face a serious shortage of water during the summer of 1920. The utmost conservation of water is urged. Timely warnings have already been given to the agricultural interests to plant only such crops as will

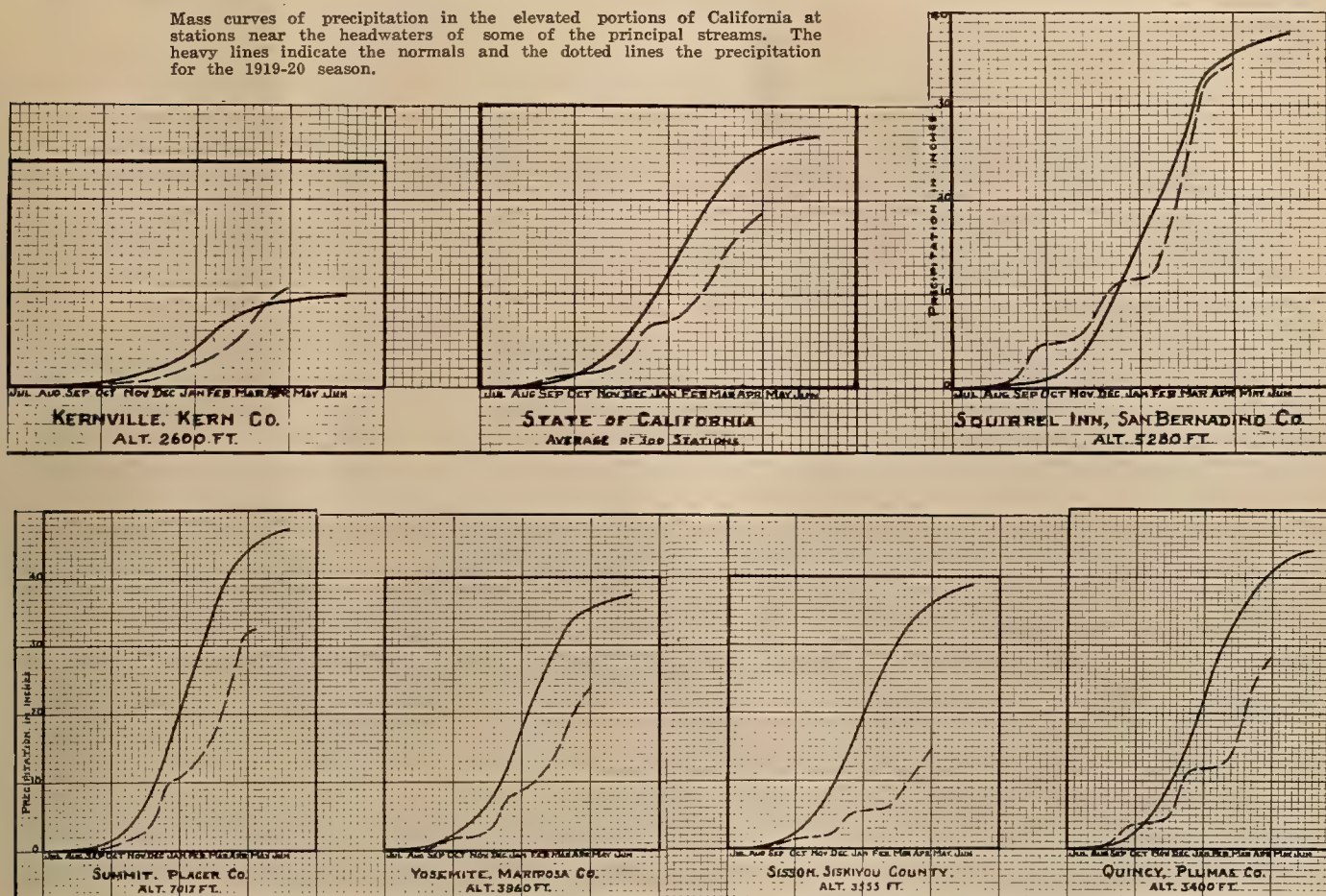
TABLE V

MEAN DISCHARGE IN SECOND-FOET															Discharge in Second-Feet Oct., 1919 March, 1920	Total Run-off in Acre-Feet Oct.—March		% 1919-20 of Normal	
PERIOD OF RECORD		OCTOBER		NOVEMBER		DECEMBER		JANUARY		FEBRUARY		MARCH		Max.		Min.	1919-20		Normal
		1919	Normal	1919	Normal	1919	Normal	1920	Normal	1920	Normal	1920	Normal						
SACRAMENTO BASIN																			
1895-1920		4,460	5,546	4,266	6,266	5,760	10,906	4,910	21,900	4,780	27,700	8,380	26,700	17,800	4,010	1,950,000	5,990,000	33	
1910-1920		2,570	2,870	2,510	3,171	3,380	3,881	2,690	6,000	2,680	7,940	3,930	8,190	7,120	2,510	1,076,000	1,833,000	58	
1910-1920		982	1,240	952	1,366	1,080	1,600	970	2,670	1,929	3,700	1,280	3,120	2,230	910	374,700	822,000	45	
1902-1920		2,010	1,880	1,810	3,380	2,340	4,090	1,730	8,870	1,800	11,600	4,130	15,200	8,800	903	840,000	2,724,000	31	
1904-1920		288	508	276	1,140	1,100	1,800	604	4,930	844	5,890	2,830	7,020	7,640	183	361,000	1,288,000	* 8	
1903-1920		17	60	18	116	136	412	54	1,470	62	1,430	1,290	1,290	1,200	9	17,400	* 209,000	* 28	
1904-1920		159	372	151	805	688	1,620	632	6,020	652	6,470	3,970	8,170	10,800	112	381,000	1,418,000	* 27	
1902-1920		0	24	0	50	0	270	0	1,740	0	2,480	2,190	2,190	0	0	* 381,000	* 275,000	* 0	
1905-1920		0	9	0	30	25	507	17	2,760	13	2,140	1,520	1,520	* 80	0	* 3,310	329,000	* 1	
SAN JOAQUIN BASIN																			
1901-1920		9	27	16	38	52	92	31	255	38	225	358	358	* 393	* 6	* 8,820	* 38,400	* 23	
1903-1920		63	110	61	93	474	171	117	492	167	492	819	819	* 3,420	* 26	* 83,400	* 82,900	* 43	
1895-1920		230	476	197	446	426	516	322	1,390	423	1,320	1,690	2,230	* 5,180	160	200,100	446,000	45	
1912-1920		88	116	112	342	366	611	353	2,640	307	4,570	5,600	5,600	* 690	* 80	* 74,000	* 494,000	* 15	
1901-1920		55	252	60	215	189	368	169	1,210	224	1,280	1,310	1,600	5,100	39	122,400	298,000	41	
1895-1920		129	256	78	367	209	507	170	1,440	232	1,760	1,760	2,930	* 705	* 45	49,300	261,000	19	
1905-1920		76	142	88	235	192	352	127	961	143	1,160	708	1,790	2,550	33	81,300	281,000	29	
1907-1920		11	22	13	63	127	224	73	134	74	1,300	1,350	1,350	* 635	* 6	* 18,000	* 105,000	* 17	
1895-1920		110	413	50	665	298	828	318	2,070	417	2,550	2,350	3,790	9,060	27	216,000	624,000	35	
1907-1920		364	574	313	470	489	743	438	1,770	503	1,690	2,600	2,600	* 2160	* 246	* 127,000	* 312,000	* 41	

*Includes data to end of February only.

Discharge data of some of the principal California streams.

Mass curves of precipitation in the elevated portions of California at stations near the headwaters of some of the principal streams. The heavy lines indicate the normals and the dotted lines the precipitation for the 1919-20 season.



require a minimum amount of irrigation water. The rice acreage has been reduced as a result.

Because of the authority it exercises over public utilities, the Railroad Commission of the State of California organized an Emergency Water Conservation Conference in order to deal effectively and efficiently with problems arising from the threatened water shortage. This Conference includes representatives of all the state and federal agencies concerned with the water problem. Precautionary advices have already been issued by the Conference. Most of the large irrigation interests of the Sacramento Valley have signed an agreement which authorizes this Conference to control and regulate all water available in that region. This step was taken in order that litigation might be avoided, and that efficient and just distribution of the available water might be secured. Mr. H. G. Butler, Power Administrator of the Railroad Commission, is authority for the statement that the financial loss to the Sacramento Valley during the coming summer will be about \$22,000,000 as a result of the deficient precipitation of the wet season now presumably closed.

Previous to March 1 the precipitation had been so light that the agricultural interests of California appeared to face disaster. The generous rains of March relieved the situation somewhat, and assured the maturing of winter growing grains and grasses. Fruit trees were revived and pastures and ranges improved. But the previous deficit was so great that the March rains, though worth millions of dollars to the state, offered only temporary relief. It is now reasonably certain that there will be a serious short-

age of water during the summer of 1920 throughout northern and central California. With a seasonal precipitation in these portions of the state less than half of the normal, the water shortage this summer is certain to be acute. Hydroelectric power and irrigation interests are advised to make plans accordingly. The utmost conservation of water is urged upon all until the next rainy season again replenishes the depleted reservoirs.

ANALYSIS OF ACCIDENTS

On the companies' premises, "handling material" comes first. Accidents from electric current—from shock, burns, eye-flash—rank fourth in a list of eighteen classes of accidents. Only .7 per cent were due to exhaustion from heat.

From a general consideration, injuries to fingers were highest, eyes next, and ears last in a classification of thirty-five anatomical locations. From the standpoint of occupation, linemen ranked first and carpenters lowest.

Of all the accidents reported, 25.9 per cent, or the highest single percentage, had all been in the employ of the companies less than six months. Those veterans of over twenty years' service contributed only 1.1 per cent to the casualty list.

While only 8.3 per cent were injured by electric current, these accidents were responsible for over 70 per cent of the total lost time, and 70 per cent of the serious and fatal accidents. The fact is, however—and it is encouraging—that 75 per cent of this class of accidents are preventable when the proper safety devices are installed.

Principles of a Profit-Making Appliance Business

BY T. W. SIMPSON

(The electrical appliance business, though perhaps fairly simple on the surface, involves a number of elements which play a vital part in the retailer's success or failure. The following article by the western district manager of the Federal Electric Company analyzes some of the main factors which make an appliance business profitable.—The Editor.)

It is possible in the electric appliance business to start with a shoestring and have ten thousand dollars in the bank in a year, but some men have that sum to start with and only the shoestring at the end of the year. Much emphasis has been laid on methods of salesmanship as a factor of success, but this is valueless without a strict adherence to the fundamental business principles that practice proves correct in this field.

Ability of the Owner or Manager

Does the manager or proprietor enjoy selling to women and the household? Is he wrapped up in the business? Would he rather demonstrate an appliance on the store floor or in the home than do anything else? Success in this field cannot come unless the responsible head enjoys and likes the work, and possesses the power and magnetism of personal salesmanship. That is why the sewing machine men, phonograph men and piano salesmen make better electrical appliance men than do contractors or others well versed in electricity. If it is repugnant to you to punch a door bell and say, "Good morning, madam," you should stay out of the electrical appliance field. You should really feel the inspiration that comes from soliciting in the interest of increasing household efficiency and relieving drudgery.

Departmentizing Sales and Contracting

If you are a contractor in any but the smallest towns it is necessary to divorce the appliance sales business from the contracting end, and put yourself or a competent manager in charge who will think appliances and nothing else. If a contractor cannot arrange to do this it is better for him to do very little with appliances, as it is too much to expect of a man that he be a good contractor and a good appliance man at the same time. Divided energies bring nowhere near the results of a concentrated effort in one field. This has been demonstrated in more businesses than in the electrical. Shoemakers cannot run shoe stores. Automobile service men cannot sell automobiles. When a hardware dealer opens up a sheet metal or tin shop his total earnings usually drop. The sales instinct and the operating instinct are diverse and there is no use in going against human nature by mixing sales work and contracting under the same hat.

Buying

Suppose it is decided to open an appliance business. What are the approved time-tested business methods to be followed? In choosing your line of goods emphasis should be laid on the profit per line per year rather than on the discount or profit on each article. The woods are full of long discount lines with no national advertising, no nearby jobbing stocks, no sales helps, and no workable plan to help finance instalment payments. On the larger items,

such as cleaners and washers, it is vitally necessary that you choose lines where the manufacturer has some workable plan of assisting in caring for the instalment contracts. A separate section below relates in detail to this most important feature. It is desirable not to overbuy so that nothing will interfere with taking cash discounts. If you have a proper way of caring for instalment contracts you can always take cash discounts on the larger items of cleaners and washers. A concern that will not take cash discounts on washers and cleaners when there is available a workable plan to get cash on its instalment contracts is open to suspicion. The legitimate source of help in buying is your bank. It is usually wise to buy washers in car lots and place the car in the warehouse and borrow on the warehouse receipt to pay the concern from whom you bought the car lot. Banks like this class of business and will loan up to 80 or 90 per cent of the factory cost to dealers on standard, well-known makes of goods. They will not loan over half this percentage on unknown or unadvertised makes, or on goods made by irresponsible manufacturers. Some dealers have bought carloads on open account and warehoused them and borrowed on the warehouse receipt and used the proceeds for other uses than paying the creditor. This is a sure road to ruin.

Sales Methods as Affecting Profit

Assuming the goods to be on hand, the details of the sales methods should be worked out to guard the concern against wasting of assets and contingent liability. The proprietor or appliance manager should be the floor manager and should sell a large quantity of the goods from the floor. Other floor salesmen should be paid a salary and a small commission on all sales made over a monthly quota. Outside solicitors should be paid straight commission and receive only one-half their regular commission on sales made that require the aid of the manager or floor force. This will keep them at work trying to close sales, yet will make them willing to appeal to the manager or floor force when it appears to them the sale is getting away from them. Salesmen should receive a larger commission for cash sales than they do for instalment sales. Salesmen's automobiles should be personally owned by the salesmen. If the concern wishes to help a salesman purchase an automobile, it should make the first payment for the salesman and insist that he pay the remaining installments. This places the responsibility with the salesman in case of accident, and involves the firm in no lawsuit arising from operation of the automobile.

Door-to-Door Solicitation

Some of the best electrical dealers believe that the day of door-to-door solicitation is passing, and

they place emphasis on the necessity of floor salesmanship, and the location of the store in recognized shopping centers with correspondingly high rentals. Possibly it may be true that outside solicitation is not absolutely necessary in all cases. It is certainly true that the demand for some electrical appliances is very strong at this time, so that many customers are looking for you as much as you are looking for them; but it would appear that the answer to this question might be found by examining the experience of kindred lines. The general agent of a large sewing machine company remarked to the writer that their sales would drop 80 per cent if it were not for house-to-house solicitation, that they had tried all possible sales plans, such as store displays, club offers, advertising, sewing schools, window demonstrations and the like, but that house-to-house solicitation was the one and only plan for continuous success. Musical instrument companies are large users of outside solicitors. The electrical appliance dealer cannot refuse to heed these signs.

This article does not treat on how to sell appliances, but the following useful hint from the experience of Mr. B. J. Holt of Woodland, California, an experienced solicitor, is given. Mr. Holt says:

"A woman may be the best possible prospect for your goods, yet she is plainly hostile to you as she opens the door. She will continue this hostility in spite of your sales talk and unless you quickly overcome it you have no chance to make a sale. To break down this wall of ill favor I have a regular plan. In my spare time I make a little device from wire that has for its object the fastening of the cloth on the household ironing board. These clips cost me half a cent each. I put a pair in a sealed envelope devoid of marking and present one to the woman as she opens the door, saying, 'I have called to distribute a little souvenir as an advertisement to the ladies of this neighborhood of our new electrical department.' She is taken aback, and seeing nothing printed on the envelope may ask what it is. Then I tear open the envelope and all she sees is a twisted piece of wire, so I get her permission to explain how it is used, and in nine cases out of ten I am invited inside to show her how it goes on her ironing board. The opening thus created makes her willing to listen to my canvass."

Conservation of the Inventory

Closely related to sales methods is the problem of demonstrations, free trials, etc. The electrical merchant who plans for success had better establish a definite rule at the start that all goods over \$20 in value must be settled for on a lease contract before leaving the store and the initial payment made. Commission salesmen will have a thousand reasons why this rule is not a good one, but the wise merchant will positively insist upon it. If a customer wants a demonstration in the home, by all means give it to her, but have it made by the salesman's demonstrating machine and not by a new article. Teach the salesman to say, "Certainly, madam, you want to see the — operate in your own home under your own conditions. I will be here with my demonstrating machine on Tuesday. Of course that is not the machine that you will get when you buy because we always deliver a brand new machine in the original crate to you so you will know it is exactly as it came from the factory and with the factory guarantee—all spic and span." This plan requires some one to come with the machine to uncrate it on the customer's premises, set it up, oil it,

and instruct the customer; but it is the customer's machine upon which a deposit has been made, and the work of delivering can be done by the service man instead of by the salesman who took the order.

In the merchant's stock care should be taken to keep as much material as possible in the original shipping package. Don't let your vanity lead you to open it all up and make a big display. As soon as it is opened depreciation sets in. First decide what stock you need for the so-called "working inventory." This should comprise floor displays and a demonstrator for each outside salesman. The balance of the stock is "liquid inventory," worth 100 cents on the dollar exactly as it came from the factory and it should be kept in that condition unopened until sold.

Turning the used demonstrators is an art. Often they can be sold at no sacrifice, by playing upon the feeling of many customers that a demonstrating machine is something specially tuned up and that it may not look as well as a new machine but it has better stuff in it or is better adjusted. The manufacturer will supply paint and refinishing material to keep demonstrating machines looking well. Don't let salesmen override you in the plea that they must have a new demonstrator to help close a deal. Do not give the salesman a new demonstrator until the old one has been sold. Many firms find it advisable to charge their outside salesmen with one-half or all of the loss taken in selling their demonstrators.

Conservation of the inventory by keeping all possible goods in original packages is a fundamental principle of successful appliance merchandising. Customers like it better and are better satisfied. There is less money tied up for the dealer. It overcomes the tendency to overbuy.

Sell on Time Only to Those Who Must Buy on Time

This important principle will take care of itself if salesmen are given a larger commission for cash sales than for time sales. Money is so tight at present that concentration should be made on cash sales insofar as possible. Some customers are natural time buyers, such as the wife of the salaried man, but farmers and men with independent businesses should be sold for cash. The farmer has no set monthly income and should pay cash, or half cash and balance after the next crop comes in. One way to do with the salaried class is to take the order on term payments and then let the collection department offer as big discount for cash as was the premium for selling on time.

Financing Term Payment Accounts

Bank examiners hold that lease contracts or instalment paper is a poor security for a bank loan and technically regard loans secured by such collateral as "unsecured." This explains why dealers obtain so little help from banks in caring for term payments. Trust companies and private capitalists take advantage of this situation by various plans to help the dealer carry the term payments. The usual plan is for the dealer to deliver say \$5,000 worth of lease contracts as collateral for a note signed by the dealer of an amount ranging from \$2,500 to

\$4,000, depending upon how much excess security the note holder demands. The dealer is then permitted to collect the accounts and make monthly remittances on his own note. Many dealers do not recognize the great amount of their capital that is absorbed by these excesses or overages of the security delivered to the financial agent as compared with the proceeds of the note. The point is that if there is an overage of 20%, 33 1/3% or 50% as the case may be, this overage is really carried by the dealer and it often drains the dealer of his capital before he realizes what is happening to him.

For instance, assume a concern selling \$5,000 per month on term payments and discounting with a financial agent that loans only 70% of the collateral security. The dealer will be doing an annual business of \$60,000 and if he sells on 12 months to pay he will have on the average \$30,000 of contracts pledged with the financial agent, since on the average his contracts are one-half paid-up, and he will owe the agent an average of $.7 \times \$30,000$ or \$21,000. However, neglecting his profit, it takes \$9,000 more money than the \$21,000 to keep him going, since he has paid for the goods and the expense of selling them represented by the \$9,000 excess, and this can come from no other source than the dealer's own capital, since the excess of contracts is already pledged as security for the \$21,000 loan. Such a dealer would require a capital invested in his business of \$9,000 to cover the overages of lease contracts held by the financial agent and in addition thereto the cost value of his inventory and of his store fixtures. This explains why dealers see their capital frittering away they know not where, and fail to realize until too late that it takes a great deal of their own capital to sell on term payments in addition to the proceeds of the notes of the financial agent.

However, there are certain financing agencies that have a plan that requires no excess or capital investment such as the \$9,000 referred to in the above paragraph. They take over each contract as it is made as a separate transaction, purchase it outright, and collect the instalment account if it seems desirable. The dealer possesses no direct liability, only a contingent liability to repurchase the contract in the event the agency cannot collect. The dealer's capital is unimpaired and he obtains his full operating profit immediately from which he pays salesmen's commissions and operating expenses and pockets his profit.

A word as to collecting instalment accounts. Most financing plans leave it optional with the dealer whether or not the collections are to be made at the store or by the financing agent direct. It seems to the writer that undue emphasis is laid on the importance to the dealer of having the payments made at the store. There are many advantages of having payments made out of town or by third parties. The customer does not demand so much free service, and it is a fact that the customer will be more prompt in payments to an outside concern or fiscal agency than to the dealer from whom the goods were obtained.

Another important point on this subject of financing term payments is that it is far better for

the dealer to use financing plans that have a connection with the manufacturer of the goods that he is selling, than it is to use outside financial schemes. Even though this necessitates the use of a different form of order blank for each class of goods sold, that is a minor detail compared with the feeling of security that comes from using a plan having a connection with the manufacturer. There is nothing whatever to prevent an outside financing agent cutting off the discount privilege at any time, and in days of money stringency or hard times this is likely to happen. In such a case the dealer is left high and dry, whereas the manufacturer of the goods that the dealer is selling will hesitate greatly before permitting his affiliated financing company to cut off the dealer's line of credit, as to do so would stop the sale of his own goods.

Servicing the Appliances

A constant leak in carelessly run appliance stores is free service. The customer says she won't make any more payments until her wringer roll is repaired, etc. The easiest and usual thing to do is for the dealer to make the repair or adjustment without charge. Manufacturers, too, have abetted this evil by being exceedingly liberal in supplying repair parts without investigation as to whether or not the replacement should come under the guarantee. The true source of complaint of some dealers that their profit margins are insufficient can be traced to this free service which has been unwisely fostered.

Experience in other businesses may be a guide. The farm tractor business of the country has been largely lost to the old-line farm implement dealers because they had an ingrained notion that they should give free service. Instead, this trade has gone to the automobile dealers or special tractor dealers simply because they have built up their business on the slogan of **no free service** and they show a profit upon margins very much smaller than exist in the electrical appliance field. The farm lighting plant builders are spreading the slogan that their dealers will not be able to survive if they give free service.

A proper policy is first of all to handle only goods that experience shows require a minimum of service and then to declare a definite policy that all service after the first 90 days shall be paid for. At the end of 90 days the customer will have a fair-sized amount invested in her appliances and will not be so likely to tell the dealer to come and take it away. During the 90 days she may have one or two service calls, but they will offer an excellent opportunity for instructions and may be considered as a part of the sale. After 90 days, free service should never be given, but on the other hand high priced service charges should not be extorted. Also take a tip from the automobile industry, and get your service man to make a written estimate of the cost of repairs and have this estimate O.K.'d by the customer before any work is done. A reasonable charge, but always a charge, should be the slogan. Excessive charges will kill your prospects of additional sales in the immediate neighborhood.

New Features of the Cedar Falls Pipe Line

BY F. R. NICHOLAS

(The fullest and most economical use of the existing water supply has been the subject of especially serious consideration during the present dry year. The following paper by the locating engineer with the Seattle Municipal Light and Power System, which was presented at a meeting of the Seattle Section, A. I. E. E., gives interesting structural details of the new Cedar Falls pipe line planned with a view to more thorough utilization of the water for hydro-electric generation.—The Editor.)

In order to utilize the major portion of the surplus and flood waters of the Cedar River watershed for additional power development and enlargement of Cedar River municipal plant, the city of Seattle authorized by ordinance the installation of an additional hydro-electric power unit at Cedar Falls, consisting of a wood and steel penstock, 12,500-kw. gen-

erator with exciter, turbine, gate valves and usual accessories.

load without danger of the water column parting on the summit, as now frequently occurs on pipe lines Nos. 1 and 2 when overload is imposed on the lines.

The diameter of the penstock is 78 in. inside measurement, applying to both wood and steel sections, and is designed to deliver 310 cubic feet of water per second at normal velocity of 10 ft. per



Existing gate house, pipe lines Nos. 1 and 2, showing opening for connecting pipe line No. 3



Trestle across Canyon Creek. By means of this structure the length of the pipe line was reduced 70 ft.

Selecting Location

After the pipe line surveys to determine the best route between the masonry dam and power house, several plans were submitted. That selected provides for location beginning at the west end of Intake tunnel and along the north bank of Cedar river to Canyon creek, the line lying below pipe lines Nos. 1 and 2 for a distance of 2600 feet, thence from Canyon creek over the summit to the power house. This location is 7474 feet in length, requiring 5306 feet of wood stave construction and 2168 feet of riveted steel pipe.

General Structure

The alignment of the line shows 8 simple and compound curves, ranging from one degree to ten degrees, the latter being the curvature limit, or a limiting horizontal and vertical radius of 573 feet. There are 9 tangents, the longest being 1760, the ratio of tangent to curvature being 75 to 28, or 2/3 tangent to 1/3 curvature. This is a gratifying economical relation when the cost of bending and springing wood stave pipes of large diameter is considered. The grades were established with this point in view, that the highest possible hydraulic efficiency might be obtained. The reduction of all sharp angles was obtained by the application of transition or spiral curves applied vertically at such points. No point on the line approaches even near the hydraulic gradient, so that the penstock may stand a heavy over-

second. This velocity is accelerated as the penstock diameter decreases to 66 in. at the turbine flange, the velocity at the turbine being 14 ft. per second.

The head loss due to frictional resistance is 4.16 per 1000 ft. of pipe line, giving total head loss of 31 ft. under full load of 12,500 kw. with velocity of 10 ft. per second—and a head loss of but 8.5 ft. for 6250 kw. with velocity at 5 ft. per second. The effective head at rated load of 18,000 hp. is 580 ft., with a guaranteed efficiency of 86% at 16,000 hp.

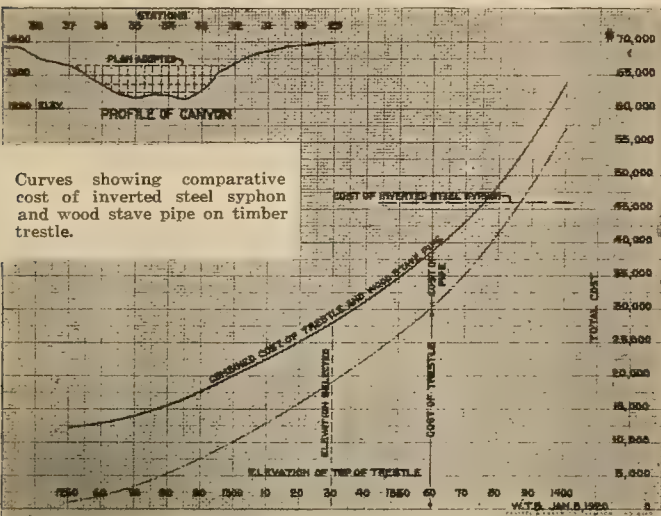
Special Features of Wood and Steel Sections

The wood pipe section is supported on 3 x 12 x 12-ft. creosoted sills laid flat and spaced 8 ft. centers, bedded securely into the pipe trench or attached to trestles as the case may be and locked to the roadbed with 12 x 12-in. saddles. No part of the pipe comes in contact with the soil or earth. It has been proved beyond a reasonable doubt that a wood stave pipe exposed to the air has a longer life than one buried or covered, as has been the practice for many years past. This is one of the new features of this installation.

The wood pipe section requires 640 tons or 24 carloads of steel bands, seventy thousand cast steel shoes weighing 245,000 lbs. (123 tons, equivalent to 6 carloads) and one hundred and ninety thousand lineal feet or 380 M. feet B.M. of 3 x 8 in. stave stock in lengths from 10 to 20 feet.

The wood stave section ends at Sta. 53-06, which corresponds to a pressure of 250-ft. head. From this point on to the power house 2168 ft. of triple riveted

steel pipe is used, varying in thickness from $\frac{1}{2}$ in. to 1-1/16 in. at the power house. Plates are rolled in one sheet with the long seam riveted above the horizontal diameter; triple riveted, double butt straps are used for longitudinal seams, single row rivets for girt ends on upper section, and double row rivets for girt seams on lower sections. The steel is fabricated at the mill and shipped in 16-ft. to 21-ft. length. The steel section is supported on concrete



saddles and securely locked in position by numerous concrete anchors, located principally at grade intersections.

The Surge Tank

On account of the length of the new pipe line and the quantity of water it is designed to carry, it would be desirable to provide a suitable surge tank for regulating purposes. The proposed surge tank is to be located on the apex of the hill above the power house. It consists of a cylindrical steel tank 25 ft. in diameter and 199 ft. in height, connecting with the 78-in. penstock by means of a 48-in. riveted steel pipe. The 48-in. connecting pipe has a tendency to suppress surges in the line caused by changes in velocities.

The surge tank has sufficient capacity to conserve the water rejected at times of sudden decrease in load. It is designed to supply the full capacity of the pipe line for a period of 70 seconds in case of sudden demand.

Improvements Over Old Lines

Comparing the new penstock now being constructed with No. 1 and No. 2 lines, we find the new line to be 307 feet shorter, and crossing the summit through a pass 57 feet lower than the present lines. At this point the new pipe line is 126 feet below the hydraulic gradient.

The sub-structures and foundation upon which the entire pipe line is carried are composed of pile and wooden frame trestles of two different types, and open trench excavations. One-third of the line is supported on wooden structures, made necessary by the fact that the line lies on a steep side hill, having a slope of 35 to 60 degrees. All frame trestles have concrete footings on solid rock foundation. Every precaution possible was taken to make the

line safe and secure from washouts which might occur at any time from the two lines above.

Where the pipe line crosses Canyon creek the type of construction using wood stave pipe on a wooden frame trestle was selected. By this method the length of line was reduced 70 feet, and the maximum head on the pipe line at this point was reduced from 340 to 240. This resulted in the saving of approximately \$18,000.

The bridges were designed for a load of 1.5 tons per running foot of bridge floor system, made rigid to prevent deflection, and span lengths 25-ft. center to center between bents, using safety factor of 6.

Due to the introduction of long spans the lumber bill was virtually reduced 50%. This departure from ordinary practice of 14 to 16-ft. span lengths for trestle bridges may also be considered as a new feature relating to pipe line construction.

Increased Power Supply

The fundamental idea of this new installation was to utilize the flood and surplus waters of Cedar river impounded back of the concrete dam. The plan was based on the assumption that the sealing operations for forebay basins would be effective, and the major portion of the annual run-off waters be used for development of additional power through this new unit.

After two years of work on the sealing operations and the expenditure of a large amount of money for this purpose, results are most discouraging as the seepage curve this past winter shows a slight increase in seepage over preceding years. To make this new unit efficient requires that the forebay basin be practically sealed. To meet this perplexing situation, a plan recently recommended proposes an extension of the Intake tunnel, through the hill to Cedar lake, tapping the lake at an elevation some 45 ft. below the present surface. By this plan there can be developed at nominal cost approximately three times the present power output of the plant at Cedar Falls. The new penstock now under construction could operate in conjunction with this proposed tunnel at any season of the year.

The present water supply from Cedar lake provides for 6,000 kw., continuous. The present installation at Cedar Falls has a total capacity of 11,000 kilowatts. Adding to this the new unit of 12,500 kw., we have a total capacity of 23,500 kw. The proposed tunnel plan provides 80,000 acre-feet of storage capacity which is sufficient to regulate the stream flow so as to give 500 second-feet continuous.

A. I. E. E. ENTERTAINMENT

Although the engineer generally does not give a thought to such distractions as poker or golf, this is not because he does not know how. As a matter of fact the engineer enjoys relaxation and the entertainment committee of the Pacific Coast Convention of the A. I. E. E. has taken this into consideration by providing various outdoor sports for the guests at Portland on July 21 to 24. Among these will be a golf tournament to compete for the cup offered by the several electrical firms in the Northwest. This has been designated the John B. Fiskens Cup as a tribute to Mr. Fiskens' activities in the electrical field.

Office Records—Their Filing and Indexing

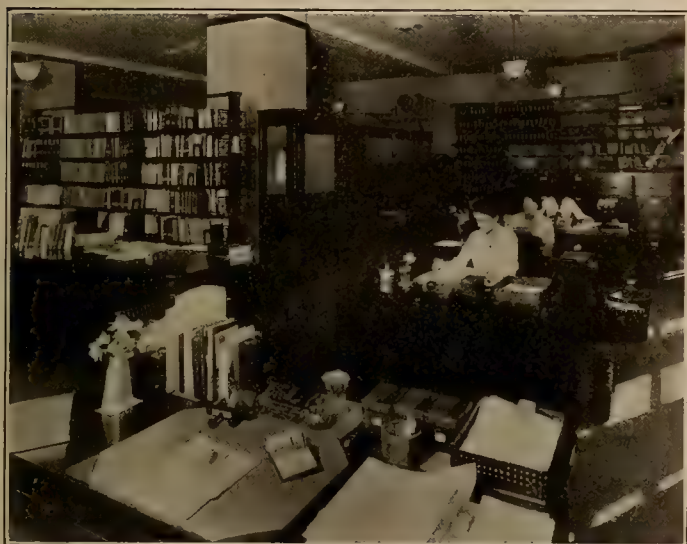
BY IRENE WARREN

(A number of simple and easily installed methods of filing special types of material are explained in this last of the series of articles by the president of the Chicago School of Filing and Indexing. The correct system of handling the correspondence and data of a sales department is outlined to suggest methods of organizing any specialized material.—The Editor.)

FILING SPECIAL RECORDS

The filing and indexing for a corporation might be compared to an electric lighting system, the central filing staff being the dynamo and the central and departmental files the lights. And furthermore, the filing system, properly handled, certainly produces informational light.

An idea of how carefully the wires for this informational lighting system must be laid in order



The Library and Information Bureau of the National Safety Council. The collection of books and serial publications to the right are filed on steel shelves. Serials in pamphlet form are placed in pamphlet boxes. In the rear of the room is the data file which consists of clippings, blue prints, typewritten sheets, reports and miscellaneous material. This is arranged alphabetically by subjects in forty-eight legal size drawers. Duplicate copies of pamphlets are placed in the pamphlet boxes which are stored on steel shelving in the back of the room. A complete card index of these materials is filed in steel cabinets in a steel safe.—Photo by Burke and Friedmann.

that light may efficiently cover every nook and corner of the business and give the proper intensive service where it is needed, may be had by scanning the typewritten and printed materials needed in operating a large manufacturing plant, as shown below.

Files and Indexes in a Manufacturing Plant

Correspondence, form letters, departmental reports, sales records, inter-office correspondence, special memoranda, special instruction sheets, comparison and classification reports, follow-up systems, superintendents' and foremen's reports, employment records, contracts, sales bulletins, salesmen's reports, foreign orders, repair orders, mail order blanks, stock room reports, requisitions, quotations, raw material records, traffic reports, bills of lading, warehouse reports, storage receipts, production records, cost tickets, pay roll sheets, vouchers, bonus sheets, expense accounts, collection reports, petty cash slips, correction slips, time sheets, advertising records, plans, blue prints, sketches, drawings, lantern slides, periodicals, pamphlets, trade catalogs, public documents and books.

An absolute essential is that heads of departments make it part of their business to explain to the filing supervisor definitely the exact nature of the service wanted. If the supervisor is properly

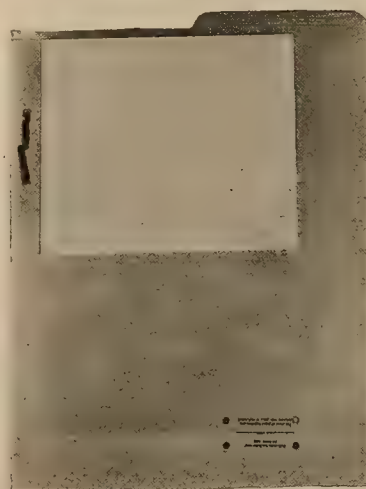
trained in system work, let him install the system and keep it in repair, just as the lighting is left to the electrical expert. So much of the difficulty existent today lies in the fact that department heads do not take the trouble to work out the details of what they need and the file clerk or some one else with only part of the necessary information does the best he can, in haphazard fashion, to devise a system. Very definite relations between the heads of departments and those of the supervising file clerk should be maintained.

Organization of Department Files

In this brief account only an outline can be given of how the records would be filed in but one of these departments, but this should be suggestive to all other specialized lines. The sales department has been chosen because its records are so necessary, so varied, and so constantly in use.

Correspondence: Sales correspondence is usually best arranged in an alphabetic name file, or geographic file; occasionally a numeric is used. The geographic is preferred if the sales cover a wide area. The letters from the salesmen are grouped together, but all letters from each salesman filed together.

Reports from salesmen: Usually each firm has its own printed forms, thus insuring a complete and uniform record on each sale. These forms are made up in pads. The salesman uses a carbon sheet, mak-

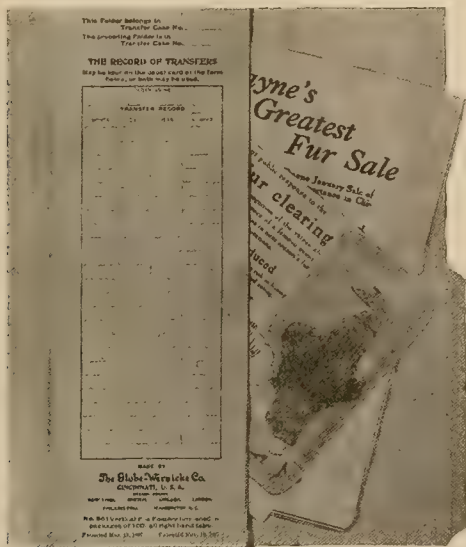


A folder which securely binds the valuable credit information concerning each individual customer.

ing the record in duplicate, one copy to be retained by him and the other sent to the sales office.

Bills and invoices: These may be filed in the correspondence folders, but a better method is to place those for each firm in a separate folder which is filed back of the correspondence folder for the firm and distinguished from it by means of a colored label.

Card records: Card records are necessary in this department and many desirable classifications may be made through the use of a single card system if tabs, colors, and signals are properly used. In



A reinforced, expansion folder convenient for filing unmounted photographs, clippings and miscellaneous data.

large corporations this information may be better divided into several card systems so that groups of workers may more readily get to the cards.

Follow-Up System in Sales Departments

An adequate follow-up system is an essential to the sales department. This may be kept through the duplicate copy of letters sent to customers or through a follow-up card record. A tab on the card indicates the prospect and this tab is cut off when the prospect becomes the customer; or, a distinct record for prospects and customers may be kept by reversing the card and placing the customer's record by itself. The prospects and customers may thus be kept in one straight alphabetic or geographic list. Follow-up work is done by the use of signals. The



Cards used in systematizing the follow-up work of a sales department

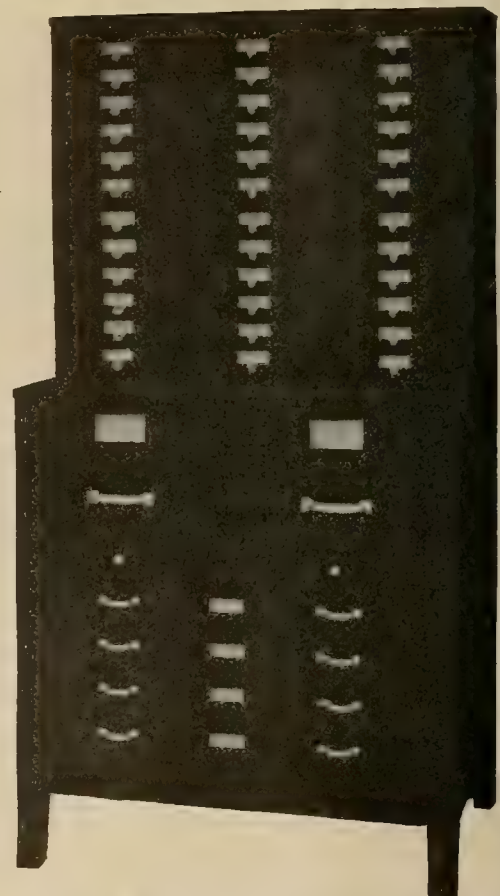
customer's record gives the main items regarding sales made so that the sales manager may see at a glance the relation of his department to the customer. In large corporations the follow-up work and the summarized sales record are better on sepa-

rate cards. A further classification of customers by agents, dealers and jobbers may be made through the use of colored cards or tabs.

The salesmen's route cards, giving their addresses as they change from day to day, are filed alphabetically by the salesmen's names.

Maps: By means of a large wall map or a series of small maps kept in shallow drawers, the manager may keep track of the routes of the salesmen and the progress of sales made in a given town.

Credit information: Credit information regarding customers is collected from various sources and is recorded on specially prepared blanks, in letters, from memoranda furnished by salesmen and from mercantile agencies' reports. This is confidential material and is usually filed in the credit department section. All the papers on a given customer are kept



File cabinet for cuts and electrotypes. The upper section is for half-tones, etchings, electrotypes and other printing plates. The middle section is for drawings, and the lower section for large drawings.

together and are usually fastened into the folder so that none may be detached or lost. These may be kept alphabetically by the customer's name, geographically, or numerically with an alphabetical card index to the numbers. A recapitulation of this information is often made in a card index which saves time in looking up many of the points needed. On this card, signals may easily be placed to indicate changing conditions that may occur in the customer's credit.

Library or research department: In the research or business library (so often started in the advertising section) may be found a collection of technical books, some books for general reference, a

large number of public documents, miscellaneous pamphlets, trade catalogs and periodicals. These are sometimes supplemented by a large collection of books loaned by the public library for distribution among the employes, the idea being that books are a definite agency for good among employes in the same manner as are gymnasiums, recreation rooms and other like agencies used for the employes' welfare. If the library collection is a large one the services of a trained librarian should be employed permanently, or if the library is not sufficiently large to warrant this, a librarian who has specialized in this phase of library work may be secured for the organization of the collection and recalled from time to time to arrange and index new material and keep the attendant in touch with the best methods of handling her materials.

Data file: Clippings from newspapers, from magazines not bound, typewritten memoranda, briefs of surveys and experiments are valuable and should be filed according to subject. Sometimes the public documents and other pamphlet literature are filed with the data. This is arranged either by a decimal scheme or by an alphabetic subject plan.

Advertising records: Copies of advertising placed are kept and may be arranged by the name of the publication, where advertising appears or by the item advertised.

Drawings and photographs: May be kept in vertical, legal size files or if large, should be placed in a large file made for that purpose such as architects use for their large drawings. These may be arranged alphabetically by subjects or by a numerical scheme with a card index.

Cuts and electrotypes: File these in shallow drawers with the face up. They are usually best arranged according to a numerical plan with a card index. The number is placed on the side of the block bearing the illustration. Sometimes the unmounted plates and even the mounted plates are placed in folders and arranged in vertical files. A print of the cut is placed on the outside of the folder.

Advertising orders: An alphabetic card index of the orders placed is kept which gives the name of the publication, space copy is to cover, length of time advertisement is to run and other details needed. Signals are used to indicate expiration of contracts. Signals, tabs on cards, or colored cards may be used to classify publications where orders are placed.

This series of articles, which has been running in the Journal of Electricity during the last six months, has been addressed to both operators and users of filing and indexing systems because we have as yet no large, well-defined group of intelligent file clerks. Every one takes a turn at the files, from the office boy to executives, which accounts for the chaotic condition of records in many places. But it is hoped that these articles have had one message to all who are interested in adequate filing methods, and that message is: We must give file clerks definite training for their work if we are to have efficient files.

Western Ideas

THE ARRANGEMENT OF BUSINESS LETTERS does more to make them readable than any other factor. The letter shown below, which was sent out recently by the California Electrical Construction Company, is a splendid example of the type which commands the reader's attention through the attractive and artistic arrangement of the information they wish to give their patrons in announcing a move to new quarters.

A more or less familiar quotation in large letters at the top of the page is certain to get the attention of the busiest man, and he then involun-



April 14, 1920.

Journal of Electricity,
Rialto Bldg.,
San Francisco, Cal.

Gentlemen:

"HE PROFITS MOST WHO SERVES BEST."

In order to "Serve"
We have found it necessary
To make a few changes
Not in our business
But in our location.

ELECTRICAL
ENGINEERS
CONSTRUCTION
MOTORS
SUPPLIES

NOTE NEW ADDRESS: Phone Sutter 2740.
687 Mission St., San Francisco.

OUR REASONS FOR CHANGING:

We are now on the ground floor.
We are able to display our lines.
We have better facilities in our stock-rooms.
We can now handle our men and material to the
Best advantage of ourselves and our customers.

Very truly yours,

CALIFORNIA ELECTRICAL CONSTRUCTION CO.

W. L. Chas. Smith
Manager.

The letter sent out recently by a Western firm to announce its move to a new location. This is an example of how attention is attracted and held by ingenious letter arrangement.

tarily reads the short tabulated sentences below. A different arrangement is used to draw special attention to the new address which is placed in the center of the page.

"THE WORLD'S MOVING when it begins to Admit Its Mistakes," is an advertisement published recently by Crowley, Milner & Company of Detroit. It is an example of the way local stores are using advertising space to correct errors which have appeared in their announcements, and they do so with the firm conviction that the building of good will is the greatest service which their advertising can render them.

The confidence of men and women can be gained most quickly and surely by admitting honestly mistakes of any sort which have been made. And so the firm which wishes to gain public confidence should realize that it can best do so by frankly calling attention to errors which have crept into its advertising columns and as frankly admitting them.

Trend of Regulation

BY CARL D. JACKSON

(In view of the pressing problem of financing new developments, few questions are of greater interest to the electrical industry than those of commission regulation and rate fixing. Following are a few interesting extracts from the able speech delivered by Commissioner Jackson of Wisconsin at the Pasadena N. E. L. A. Convention.—The Editor.)

It has become increasingly apparent in recent years that the problem of economic production and distribution of essential products depends for its solution upon the use and distribution of natural forces by electricity.

* * * *

After all, every question of the wisdom or policy of private or government ownership and management must be solved with reference to the underlying problem. Under which policy will the people as a whole receive the greatest economic benefit? Which policy will bring to the industry that enterprise, development and economic and efficient management that will in the end be reflected in conservation and full use of resources?

* * * *

Regulation must not only perform its functions of assuring to the public fair and reasonable treatment in all matters of service, safety and rates, but must also broadly exercise its general functions to encourage and reasonably reward those supplying the energy, enterprise and capital, without which the highest development is impossible. The industry must be attractive, or it will not flourish.

* * * *

The very pressing problem has been to meet the extraordinary, threatening and sometimes discouraging conditions in relation to public utilities that have been the outcome of the war. The extraordinary present interest rates for public utility securities, intrinsically sound, are a great handicap to extension and absolutely necessary development.

* * * *

The assignment of a constantly fluctuating value to property devoted to a public use has nothing to recommend it from my point of view. To the owners of public utility property, it may offer for the time being highly speculative rewards, but just as surely promises unreasonable losses and failures and unnecessary risk in enterprises which if wisely undertaken and managed should offer fairly sure and stable rewards. A fluctuating value may be attractive to those who see their reward only through shrewd manipulation of securities, but will not appeal to those who seek the rewards reasonably due to those conceiving large public enterprises in a public spirit for the mutual advantage of themselves and the public.

* * * *

The matter of valuation in rate cases is not an end in itself, but only a step in arriving at the end, which, within the limits of reasonableness, is the amount of compensation to be allowed the capital employed in the business. It has been repeatedly stated that the return which a public utility company should be permitted to earn under normal cir-

cumstances should be such a return as will permit the free flow of capital into the utility business. In the end, therefore, the amount of return resolves itself into a matter of compensation for capital presently employed or about to be employed in the business, and it is self-evident that if the rate or amount of return is adequate to provide proper compensation and attract capital, there is no object in changing the rate base from time to time, except as the amount of capital employed changes. On the other hand, if the rewards for capital employed are not sufficient, no matter what the rate base used, there will be a failure of enterprise and development resulting in inadequate service and in the end in unnecessarily high rates to the public.

* * * *

The concept of value as wholly analogous to exchange or commercial value of marketable commodities has, I believe, led directly to a misconception of the effect of accrued depreciation in arriving at a rate base. Everybody knows that a used machine or automobile is not as valuable and will not sell for as much as a new one. Why should public utility property not be subject to the same exchange or commercial laws? And if value is exchange, commercial and fluctuating, it is hard to explain why commercial and exchange elements relating to use should not be an applicable factor. If, however, you exclude this concept of exchange value and think of value as closely related to legitimate investment, which in turn represents the sacrifice made by the owners of the utility, the mind is at once freed from this question, and the question of accrued depreciation; that is, accrued liability to replace, immediately becomes connected with the question of depreciation reserves, failure to set aside depreciation reserves where they could reasonably have been set aside, and the question of return to the investors of a part of the investment made by them. If value in the long run is somewhat analogous to investment, then every rule of equity demands that the question of accrued depreciation shall be considered in connection with the question of the investment still in the utility.

* * * *

It is fundamentally true that the people as a whole have a keen sense of justice and right, and in the long run will with full understanding generally arrive at a correct decision. The difficulty is in getting the full facts before the people, and this is especially so in matters disputed before commissions. It may often occur that the people do not realize the benefits which they themselves have received from regulation. The people are entitled to and will insist upon reasonable rates, but they are willing to pay for good service.

SPARKS—Current Facts, Figures and Fancy

(The electric scrubbing brush, curling iron, cigar lighter and sewing machine are among the various novel devices mentioned on this page. Have you heard how much the French plan to spend on railway electrification in the next few years or what Brazil is planning in the way of hydroelectric development? These and other similar bits of electrical information appear below.—The Editor.)

The Ford Company is now putting out over 3,000 cars a day, three times as many as a year ago.

* * *

On dark nights a white light can be seen farther than any color; on bright nights red takes the first place.

* * *

Hotels are installing the nickel first electric fan which operates for an hour on one nickel. The cheapest comfort on the market.

* * *

The longest telegram ever sent was on May 22, 1882, when the entire New Testament as revised was sent from New York to the Chicago Tribune.

* * *

Some mothers have found that a brush screwed into the shaft of a sewing machine motor makes it possible to clean the blackest spots on Johnny's clothes with no other rubbing or scrubbing.

* * *

The electrically-propelled sewing machine may be especially recommended to the economical housewife on the ground that it costs no more to operate a sewing machine motor than for the glow of one electric lamp.

* * *

The comfort of street car passengers is greatly enhanced in the city of Los Angeles which is the first city in the United States to lessen street noise by using a shockless street car crossing, which is also practically noiseless.

* * *

The electric curling iron ranks among the most versatile of domestic electric appliances. It has recently been discovered that this piece of boudoir apparatus may successfully be used to heat a glass of water or to warm the baby's bottle.

* * *

The electrification of French railroads which is planned to take place during the next few years will amount to an expenditure of 2,700,000,000 francs. It is estimated that a saving of 1,500,000 tons of coal a year can be effected by this electrification.

* * *

Tele-photography is the latest and most startling of recent radio inventions. A system is being perfected by which a picture is built up by dots of varying magnitude, each of which has a special code letter so that photos can be telegraphed, cabled or radioed practically any distance.

The air mail has been in operation for twenty months, carrying to date more than 22,000,000 letters between Chicago, Cleveland, New York and Washington, at better than twice the speed of the Congressional Limited or Twentieth Century.

* * *

Plans which are being made for the electrification of foreign railroads are surprisingly wide in their scope. Extensive projects are soon to be carried out in Italy and South America and it is expected that Portugal will follow in Italy's footsteps.

* * *

A device has been perfected which makes it possible to detect the presence of icebergs by measuring the amount of salt in currents of sea water. The vital part of the device is an electrolytic cell which measures the electrical resistance of ocean water by the aid of alternating current.

* * *

California crude oil stocks were reduced from 24,432,175 barrels, May 1, to 23,914,537 barrels, June 1—the actual reduction being 517,638 barrels for the month. These statistics show the daily shortage for the month to be 16,698 barrels, an increase of 2,222 barrels over the April daily shortage of 14,476 barrels.

* * *

Men working outside where wind extinguishes matches before the sulphur tip is burned find electric cigar lighters highly satisfactory, while the business man is able to keep a neat nickel-plated case in his vest pocket, always ready for use, without having his garments littered with an assortment of broken and mouldy matches.

* * *

The Government of Brazil is financing a survey of the hydroelectric possibilities of the Iguazu falls in the northeastern corner of that country. According to the present plans, 150,000 horsepower is to be developed from the falls, this amount later to be increased to 300,000. The power will be transmitted over an 800-mile stretch to Buenos Aires.

* * *

The number of ocean-going commercial ships passing through the Panama Canal during the month of April was 220, inclusive of 10 United States Navy vessels, 2 United States Army vessels, 4 merchant ships with coal for the Navy, and 1 British tug with negative United States tonnage. The net tonnage, Panama Canal measurement, of the 220 commercial vessels aggregated 822,471—3,109 tons greater than for the preceding month.

PERSONALS

James H. Bonner, chief engineer of the Montana Railroad commission, is assisting in an unusually helpful manner



in gathering data for the Montana Railroad Commission whereby utilities of that great commonwealth may be put on a better and firmer financial footing due to the present increase in cost of production. Details of this interesting work will be found elsewhere in this issue. Mr. Bonner is a graduate of the University of Montana with the class of 1907, where he received his major engineering work under the direction

of Robert Sibley, editor of the Journal of Electricity, who at that time was head of the Engineering School at the University of Montana. Since graduation Mr. Bonner served for a number of seasons as county engineer for the county of Missoula, Montana, in which he acquired a broad engineering knowledge. Later he engaged in quite an extensive consulting engineering practice. He served during the war as a captain of engineers, and upon returning from service entered employment with the Montana Railroad Commission where he has for the last two years been serving as its chief engineer. Mr. Bonner represents the younger type of engineer in public service, and with his constructive thoughts and ideals many new and practical good things for the utility life of the state of Montana may be expected to follow.

Joseph E. Johnston, advertising representative of the Journal of Electricity for the New York district, is a Pacific Coast visitor.

C. R. Churchill, president and general manager of the Electric Appliance Company of New Orleans, Louisiana, is a recent San Francisco visitor.

S. Hall Roosevelt, railway engineering department of the General Electric Company, Schenectady, has recently visited the San Francisco office of the company.

G. C. Pierce, vice-president and general manager of the Northwestern Electric Company, is in San Francisco on business in connection with interests of the Northwestern Electric Company.

H. F. Jackson, vice-president and assistant general manager of Pacific Gas & Electric Company, has recently gone to New York in connection with the sales of securities of the Sierra and San Francisco Power Company, of which he was president.

Willard S. Sisson, secretary and treasurer of the D & W Fuse Company, Providence, R. I., severed his connection with the D & W Works on June 15th, as the plant is now operated by the General Electric Company under a long term lease. Mr. Sisson will continue in the electrical business, and will announce his plans in the near future.

M. C. Osborn, who is well known to all Pacific Coast electrical men and for many years commercial manager of the Washington Water Power Company at Spokane, and for the past year associated with Landers, Frary and Clark at New Britain, Connecticut, has resigned his position with that company. At the present time he is visiting his son in Seattle, Washington.

E. W. Garcia, after ten years' experience with the General Electric Company with headquarters in San Francisco,

has become associated with the Pacific States Electric Company and will have charge of incandescent lamp sales. Mr. Garcia has left for the East to spend some four weeks in visiting factories and research laboratories concerned with lamp manufacture.

J. A. Vandegrift of the National Lamp Works, Oakland, California, has been East attending the annual Sales Conference of the various sales managers of the National Lamp Works which was held in Cleveland, Ohio, and also for the annual meeting held on Association Island, Lake Ontario, New York. When Mr. Vandegrift left for the East he intended to return about the first of July.

The following western engineers have been elected to associate membership in the American Institute of Electrical Engineers: **B. P. Bailey**, District Manager, Pacific Power & Light Co., Astoria, Wash.; **C. G. Batt**, Chief Electrician, Utah Apex Mine, Bingham Canyon, Utah; **W. S. Boutwell**, Service Engineer, Westinghouse Electric & Mfg. Co., Seattle, Wash.; **B. W. Creim**, Test Dept., Bureau of Power & Light, Los Angeles, Cal.; **R. C. Denny**, Operating Engineer, San Joaquin Light & Power Corp., Fresno, Cal.; **J. M. Evans**, Salesman, Westinghouse Electric & Mfg. Co., Fresno, Cal.; **H. M. Fowler**, Electrical Engineer, Westinghouse Electric & Mfg. Co., Seattle, Wash.; **W. H. Keyser**, Sub-Foreman, Electric Construction, Puget Sound Power & Light Co., Seattle, Wash.; **E. F. Maryatt**, Electrical Draftsman, Stone & Webster, San Francisco, Cal.; **J. C. McDougall**, Engineer, Westinghouse Electric & Mfg. Co., Seattle, Wash.; **E. M. Moore**, Local Manager, Washington Coast Utilities & Vashon L. & P. Co., Portage, Wash.; **O. B. Moorhead**, President & Chief Engineer, Moorhead Laboratories, Inc., San Francisco, Cal.; **A. K. Morehouse**, Division Equipment Foreman, Pacific Tel. & Tel. Co., San Francisco, Cal.; **W. A. Murray**, Instructor in Electrical Engineering, Univ. of Idaho, Moscow, Idaho; **J. G. Pomeroy**, Electrician, City Light Dept., Seattle, Wash.; **L. W. Ross**, Telephone Engineer, Pacific Tel. & Tel. Co., Portland, Ore.; **D. F. Smith**, Transmission Engineer, Pacific Tel. & Tel. Co., San Francisco, Cal.; **G. H. Smith**, Engineer Outside Construction, City of Seattle Lighting Dept.; **H. M. Snow**, Operator, Hartwig Theatre, Dillon, Mont.; **H. K. Townsend**, Chief Clerk to Electrical Engineer, S. F. O. T. Railways, Oakland, Cal.; **F. H. Viets**, Division Engineer, Research Corporation, Anaconda, Mont.; **R. L. Von Lossow**, Engineer Service Dept., Westinghouse Electric & Mfg. Co., Seattle, Wash.; **C. A. Wells**, Engineer, Pacific Tel. & Tel. Co., San Francisco.

E. F. Whitney, manager of the lumber industries department of the General Electric Company, Portland, Ore.,

and chairman of the Portland section of the American Institute of Electrical Engineers, is attending the annual convention of the Institute which is held at White Sulphur Springs, West Virginia, June 29 to July 2, as the official representative of the Portland section. On his way to the convention Mr. Whitney passed through California where he stopped for several days gathering information in the interests of the



important lumber industry in the Northwest. As the hosts to the Pacific Coast Convention of the A. I. E. E., the Portland section is making extensive plans for the entertainment of a large number of delegates, and it will fall largely to the efforts of Mr. Whitney to make this convention a success. This photo of Mr. Whitney was intended for the pages of this issue devoted to the Western Engineers, but was received too late for that purpose.

Henry Suzzalo, president of the University of Washington, was one of the forceful speakers at the recent Foreign Trade Convention in San Francisco, and also on the evening devoted to Public Policy discussion at the Pasadena Convention of the National Electric Light Association. Mr. Suzzalo is one of our active factors in the West in the development of more intimate relations between the university and the industrial life of the West, and he has in the Northwest proven a most helpful factor in the settlement of industrial disputes, in the arbitration of the electric railway labor troubles and in many other matters of service to the industry and to the commonwealth. Mr. Suzzalo is a graduate of Stanford University with the class of 1899. Since graduation he has devoted his energies to the development of educational matters, in which he has won his present position of eminence in the educational and business world.



Girard B. Rosenblatt, electrical engineer and specialist in mining and metallurgical applications with the Westinghouse Electric and Manufacturing Company, announces the removal of his office to 521 First National Bank Building, San Francisco.

L. E. Kurtichanof, formerly electrical engineer for the Standifer Steel Shipyard at Vancouver, Washington, has resigned his position and will open up a battery service station at Tenth and Davis streets, in Portland, having secured the state agency for the "Titan" battery.

L. W. Chapman, western editor of Chemical and Metallurgical Engineering, who during a recent trip through the Northwest made a careful study of the possibilities for the development of electro-chemical processes, reports that the present conditions would not warrant great increases in this branch of the industry until the magnitude of the manufacturing assured is sufficient to make the development of some of the larger water powers economical.

H. W. Crozier, local manager of Sanderson and Porter, has recently returned from France where he designed an oil pipe line to run from Havre to Paris. This line will transport the Mexican oil brought into the port of Havre direct to Paris where it will be used to take the place of coal, as that commodity is very scarce and the price almost prohibitive. Mr. Crozier designed the Coalinga-Martinez pipe line and stated that the new line will practically duplicate it.

John H. Wilson, mayor of Honolulu and a graduate of Stanford University, has been elected president of the Honolulu chapter of the American Association of Engineers. The vice-president of this newly formed chapter is Lyman H. Bigelow, superintendent of public works and chairman of the Board of Harbor Commissioners of the Territory of Hawaii, and a graduate civil engineer from Cornell University. This newly formed chapter has forty-four members and is the second chapter of the Association to be formed outside of the United States, the first being located at Anchorage, Alaska.

G. J. Young, Pacific Coast editor of the Engineering and Mining Journal, has just completed a four weeks investigating trip through the Birmingham, Ala., and southeastern Arizona mining districts where he made a study of conditions particularly appertaining to the installation of electrical apparatus. Mr. Young noted great progress in these districts. In Alabama the use of electrically driven machinery is only now getting a foothold in the mining industry. In Arizona a large part of the power is electric, although there remains much to accomplish in substituting motors for steam engines.

L. S. Ready, assistant chief engineer of the California Railroad Commission, has been sent to the annual convention of the American Institute of Electrical Engineers as the representative of the San Francisco section. Mr. Vincent, chairman of the section, was unable to attend the meeting.

John A. Britton, vice-president and general manager of the Pacific Gas & Electric Company, gave the opening address at the recent formal dedication of the Electrical Home which has been built at 25 Junipero Serra Boulevard, St. Francis Wood, San Francisco. The Home Electrical, a modernly built and equipped electrical home, has created great interest throughout the San Francisco Bay region.

T. E. Burray, vice-president of the New York Edison Company, president of the Yongers Electric Light and Power Company and vice-president of the United Electric Light and Power Company, recently received the degree of Doctor of Science from Villa Nova College, Pennsylvania. Mr. Murray is one of the foremost men in the electrical industry today. He bears the unique distinction of having installed more power plant capacity than any other man. In 1910 the Franklin Institute awarded Mr. Murray the Edward Longstreth Medal for his system of safety devices and protective appliances for interior electric wiring. Altogether Mr. Murray has been granted more than 350 patents, principally for electrical inventions.

R. W. Conlisk, who has recently returned from service in the Signal Corps in which he was finally promoted to the rank of captain, has been employed by the Westinghouse Company to fill the position of illumination engineer in the San Francisco office. Mr. Conlisk is now at the East Pittsburgh plant of the Westinghouse Company becoming familiar with the details of the duties his new position will require of him. Upon his return to the West he will be active in the work of promoting better lighting in industrial plants, many of which are now badly in need of increased illumination. The Westinghouse Company is doing a great part of the work in educating the industrial plants to the value of proper industrial lighting as a means of increasing plant efficiency and output and of decreasing accidents.

Howard H. Bliss, supervisor of the department of vocational education of the state of Nevada with headquarters at

Reno, is a recent San Francisco visitor. It will be recalled that Professor Bliss, while in charge of technical instruction of the Extension Division of the University of California, was the author of an extensive series of articles in the Journal of Electricity for home study, which was followed by a broad and widely distributed list of our readers. Mr. Bliss has in preparation another series of interesting articles, the first of which will appear in the Journal of Electricity in the July 15th issue. Central stations, jobbers, manufacturers and contractor-dealers should call to the attention of their employees this forthcoming series because it will prove of unusual helpfulness.



OBITUARY

Mr. Ralph G. Hemingray, president of the Hemingray Glass Company of Muncie, Indiana, died at Covington, Kentucky, May 11th.

Henry C. Doerr, president of the Garden City Electric Company, San Jose, and of the Santa Clara County Builders' Exchange, died at his home a short time ago. He was a director of the Merchants' Association of that city.

Meeting Notices for Electrical Men

(The opening of the San Francisco "Electrical Home," the annual dinner of Pacific Service employes, and the recent Washington, D. C., Conference of Engineers are the prominent events recorded in these pages. The activities of Northwestern contractor-dealers and of illuminating salesmen are also reported.—The Editor.)

Electrical Home Day at Development League

Celebration of the opening of the "Electrical Home" in St. Francis Wood was substituted for the June 14th meeting of the San Francisco Electrical Development League, and the idea of boosting the "electrical home" conception was enforced by all of the speakers. D. E. Harris, sales manager of the Pacific States Electric Company, was chairman of the day and opened the meeting by stating that the electrical home idea was started in a campaign to secure more convenience outlets in the home and that the home now on exhibition in St. Francis Wood was the result of this campaign.

Lee H. Newbert, commercial manager of the Pacific Gas & Electric Company, then traced the development of the electrical home idea on the Coast and went into detail concerning the work of the California Cooperative Campaign in this respect. He gave credit to the San Francisco Electrical Development League for the untiring work committee members have done to secure more complete wiring of homes. The publicity campaign that is being carried on by the League was explained by M. T. Dolman, of the Pacific States Electric Company, who has been assisting W. C. Hopkins, Westinghouse Electric & Manufacturing Company. Mr. Dolman stated that the publicity committee had printed 500 street car cards, 200 window cards, seven bill boards, 5,000 circulars, and had inserted 796 column inches in the newspapers.

On Friday, the opening day of the Home, there were 200 visitors, 400 on Saturday and over 1600 on Sunday, showing that the widespread advertising done by the committee had brought results. Mr. C. C. Hillis, manager of the Electric Appliance Company, made the report of the finance committee and stated that while the jobbers and manufacturers had turned in their contributions complete, the contractor-dealers and central stations had not as yet turned in their quotas. This, he stated, would be in shortly and it might be necessary to make another appeal for funds as the publicity was more extensive than was at first planned.

R. M. Alvord, General Electric Company, then outlined the system being used at the home for selling the idea and stated that no salesman was allowed to give prices on the various articles on display and that no literature was being given out that was not of a general nature. There was need, he stated, for five salesmen out there each day and asked for the cooperation of the manufacturers and jobbers in furnishing these. He closed by asking that all electrical men who meet the public do all in their power to sell it the "home electrical" idea.

The last speaker was Robert Sibley, editor of the Journal of Electricity and Pacific Coast editor of Electrical World and Electrical Merchandising. He stated that in his visit to the home the idea that most impressed him was that it was not an electrical show but a modern home fully equipped with electrical appliances. In bringing the meeting to a close Chairman E. O. Shreve spoke of the constructive work being done by the Journal of Electricity and stated that the electrical fraternity should show its appreciation of this fact. The meeting closed with a vote of thanks to the members of the League who had worked so hard and given their time so unselfishly towards making this electrical home a success.

Oregon Contractor-Dealers Approve the California Cooperative Campaign

The regular bi-monthly dinner and business meeting of the Oregon Association of Electrical Contractors and Dealers was held Monday evening, June 14th, at the Portland Chamber of Commerce.

The evening was devoted to listening to and discussing reports from Messrs. E. L. Knight, C. P. Scott and John Tomlinson covering their trip to Pasadena.

All were enthusiastic over the workings of the California Cooperative Campaign and the recommendations that this association work with and heartily support the Advisory Committee of the Northwest Electric Light & Power Association were warmly received.

The delegation from the Oregon Association presented very complete reports covering the Contractors and Dealers' Convention, the N. E.

L. A. Convention and the California Cooperative Campaign and also their observations concerning methods and practices of jobbers and contractor-dealers in California.

A number of central station men and jobbers were present and upon invitation presented their impressions of the conventions and the possibilities of cooperation in the Pacific Northwest. Among those who were invited to address the meeting were A. C. McMicken, P. R. L. & P. Co., J. D. Scott, P. R. L. & P. Co., and George Boring, Pacific States Electric Company.

The Oregon Association of Electrical Contractors and Dealers is in a very healthy condition and is the strongest association of its kind in the Northwest.

Illuminating Salesmen Meet

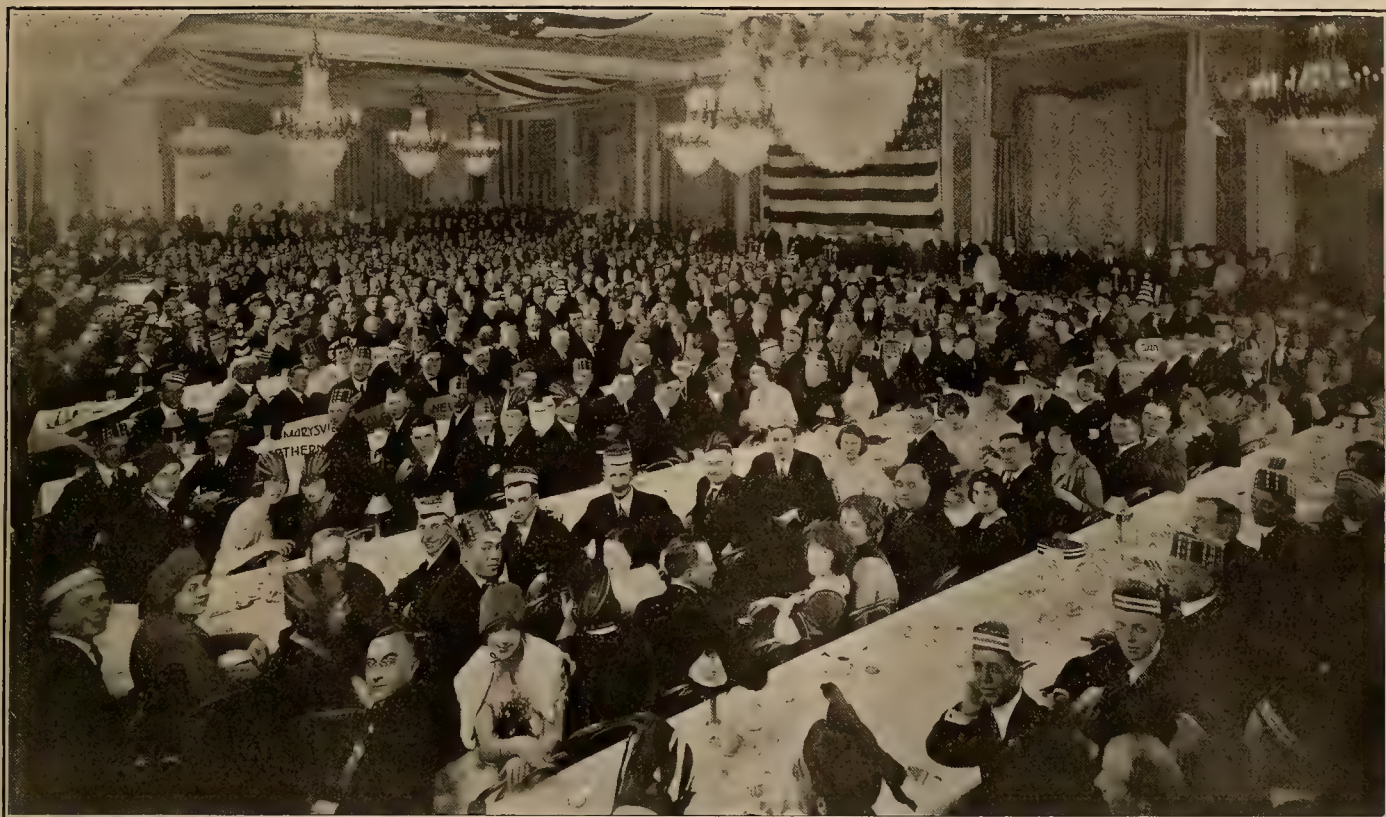
In line with their policy of so training their representatives that they may most intelligently discuss lighting problems with customers and prospective customers, the National Lamp Company gathered 36 of their agents and sub-

BUILDERS OF THE WEST — LXXX



GEORGE E. QUINAN

In the design and in the drawing of specifications for safety control in transmission line installation in the West, an influence has been brought to bear that has been felt throughout the nation, and has again won for this section of the country a place in full keeping with its triumphs of engineering attainment. To George E. Quinan, chief electrical engineer of the Puget Sound Power & Light Company, this issue of the Journal of Electricity is affectionately dedicated in appreciation of his contribution to the development of our industry in the West in connection with safety control in transmission line construction, and for his helpful activities in engineering discussion and Institute affairs in the Northwest.



Nearly 900 enthusiastic employees of the Pacific Gas & Electric Company gather for annual reunion and dance.—Photo by Morton & Co.

agents at the Palace Hotel, San Francisco, on the evening of June 15, where they were addressed by Clark Baker, assistant to the general manager for Pacific Coast Division of the National Lamp Division of the General Electric Company, and Wm. M. Rosborough, who occupies a similar position to that of Mr. Baker.

Mr. Baker outlined results of an extensive survey of industrial lighting which proved that practically 40 per cent of industrial plants stood vitally in need of more light which would not only tend to prevent accidents, but would conserve the eyesight of the workers as well as result in a greatly increased production. Mr. Rosborough described in a most interesting way the development of the portable foot-candle meter, which is to lighting what the thermometer is to heating. This instrument, which is being put in the hands of those who are striving to improve the lighting conditions in the factories, stores and homes, is sold at the actual cost to the manufacturers in order that the lighting salesman may be able to show, in a convincing way, the actual results that are obtained through changes in illuminants or rearrangements or better maintenance of those now in service.

Pacific Service Employees' Annual Dinner

The fourth Annual Dinner of the Pacific Service Employees' Association was held at the Palace Hotel on the night of June 17th. Mr. R. E. Fisher, chairman of the association, presided at the dinner and entertainment was furnished by the Pacific Service orchestra and by the cast of the opera which was produced by the association last year. The majority of the directors of the company were present at the dinner and the guests of honor included the Hon. E. O. Edgerton, president of the California State Railroad Commission, and H. W. Brundige of the Railroad Commission. In making his opening address Chairman Fisher said, in part:

"The duty of the company is to see that the employees are cared for in sickness and in health, with some promise of a final reward for continuous, constant and loyal service; to have a better knowledge and acquaintanceship with employees' families and their needs; to provide proper recreation facilities and the opportunity for employees to get together for discussions of the problems involved in their daily tasks. The employees should know more of the business in which they are engaged—not merely

perform in a perfunctory manner the tasks allotted to them, but should have a proper vision of what the utilities' service means to the public, and the management should share in some reasonable way with the employees the problems, difficulties and anxieties, as well as the ambitions that confront them in their task.

Mr. John A. Britton, vice-president and general manager of the company, was the next speaker, and he proceeded to introduce the directors of the company, including President Drum, and as each one's name was called he was requested to rise so that he might be recognized by the employees. Mr. Britton finished his speech by thanking all of the members of the association for their cooperative work and asked for the same cooperation in the year to come.

The next speaker was E. O. Edgerton, who stated that the employees of a public service corporation were in reality employees of the public, and he said he did not believe that it was good policy for regulatory bodies to attempt to fix the wages of central station employees. "It is of vital interest to the public," he stated, "that capital be attracted to the public utilities, and to be attracted capital must be afforded a safe and sure and certain return. He then spoke of the reward for efficiency and stated that this reward should not be held out as something to take place in the distant future but to be an immediate reward in the form of promotion or increase in wages. He finished by stating that the shortage of power this year had proved how widely industry and agriculture are dependent upon hydroelectricity for their maintenance and growth and stated that the day was coming when an employee of a public service corporation would be proud of the fact that he was so employed and was rendering the greatest service possible to the public.

After Mr. Edgerton's speech there was a moving picture showing "Pacific Service at Work and Play," being scenes taken at the different power houses of the company and of the activities of the Pacific Service Employees' Association. A prize of \$10 had been offered to the employee of the company writing the best words on "Pacific Service" to a popular song. The songs that had been handed in were thrown upon the moving picture screen and the members of the Association

joined in singing the words. The award of the prize was judged by the amount of applause and the spontaneity of the singing of the song. The prize was awarded to Miss Rowe of the Chico district. After this contest the rooms were cleared and the rest of the evening was spent in dancing.

Representatives were present at the dinner from each of the twenty-five districts of the company, from Redding on the north to Fresno on the south and from Drum district on the eastern border of California to San Francisco on the west. There were fully one thousand people present and a great deal of credit should be given to the Pacific Gas & Electric Company for fostering such meetings and giving the employes an opportunity to meet on common ground, together with the officers and directors of the company.

Conference of Engineers

The Conference of Engineers at Washington on June 3 and 4, to formulate a plan for a federation of engineering and allied technical societies, was a notable gathering and the results of the conference should prove acceptable to all who desire to have the importance of the work of the engineer, architect and technologist better recognized than heretofore, and who believe that the members of technical professions should be collectively in position to serve the public and to look after matters of concern to these professions.

The Joint Conference Committee which called the conference is made up of representatives of the American Society of Civil Engineers, the American Society of Mechanical Engineers, the American Institute of Mining and Metallurgical Engineers. This committee had prepared a draft of a constitution for a Federation of Engineering Societies which naturally was made the basis of the constitution as finally adopted by the Conference. But other plans were submitted and received consideration by the Conference, which early in its proceedings had resolved that the national organization to be proposed by the Conference should be an affiliation of societies and not a new organization of individual members.

Of these other plans one known as the Alvord Committee plan was submitted by the Board of Direction of the American Society of Civil Engineers, without recommendation. The Alvord Committee, it will be recalled, was appointed by the Board of Direction of the American Society of Civil Engineers to give consideration to the Joint Conference Committee report, and dissenting from the views of the latter, submitted an alternative proposition. It was suggested by this committee—one member dissenting—that Engineering Council as at present constituted should be continued with enlarged powers.

Engineering Council is built up of representatives from the four so-called founder societies and the Society for Testing Materials, the representatives being selected by the governing bodies of these societies. The plan of the Joint Conference Committee differing radically from the Alvord Committee plan, by providing for a representation of local organizations in the national organization, was considered by the Conference to have advantages.

The Joint Conference Committee plan provided for the formation of a body of representatives to be known as "American Engineering Council." On this body local organizations, or local affiliations, and national or regional societies are to have representation on the basis of one representative for the first 100 to 1000 members, and an additional representative for each additional 1000 members or major fraction of this number. This plan provided, also, for an Executive Board of 30 members of which 6 members are the officers of Engineering Council and the other 24 are to be elected, in part, by the national societies, the allotment to the districts and to the national societies to be on the basis of relative membership. The Conference modified his allotment by mak-

ing the representation on the Executive Board proportional to representation in the Council, thereby increasing somewhat the representation and influence of the local societies in the Council. The committee on constitution and by-laws first resolved to recommend "Confederation of American Engineering Societies," but reconsidered and reported to the Conference "Federated American Engineering Societies," which is the name as finally adopted.

The American Association of Engineers was represented in the Conference by 17 delegates. Their plea that their organization be made the comprehensive all-embracing National organization was not favorably received. Except for this delegation the Conference was unqualifiedly in favor of a federation of societies and even this delegation cast its vote for the Federation of Societies though declining to vote on the plans as finally adopted.

The delegates of the American Association, among other moves, presented a resolution to the effect that provision should be made in the constitution of the new organization for referring all matters concerning the welfare of the individual engineer or technical man to the American Association. This the Conference considered a matter of procedure and referred the resolution to the new National organization.

The Conference was presided over by Calvert Townley, president of the American Institute of Electrical Engineers. His ability and tact as a presiding officer were universally commented on and contributed materially to the expeditious and thorough consideration of the problems before the Conference.

While the outcome of the Conference is necessarily more or less of a compromise, the proposed plan of a national federation of engineering and allied technical societies is as democratic as circumstances will permit and is worthy of a fair trial.

It remains to be said that a federation as now proposed will not interfere with the functioning of the various National Societies. Their work will go on as in the past. All that they are called upon to do is to join in the federated societies and send representatives to American Engineering Council. No method has been prescribed nor suggested for the selection of their representatives. It is left to each member society to determine for itself how its representatives are to be selected.

San Francisco Electrical Development League

John A. Britton, vice-president of the Pacific Gas & Electric Company, speaker of the day at the June 7th meeting of the San Francisco Electrical Development League, introduced Marshall Hale, vice-president of Hale Brothers Department Store, speaker of the day, by tracing the development of merchandising from the time of the ancients down to the present day. Mr. Britton stated that the one thing necessary for the success of a merchant was honest trading that would win and keep the confidence of the people.

The topic of Mr. Hale's address was "Modern Merchandising" and he started by stating that the present conditions were due to high wages, the extravagance of the public and the government, and the scarcity of labor. He went on to say that every article in a house is the product of labor and profit and that the item of labor was approximately eighty-seven per cent while the rest of the cost of an article was profit. Mr. Hale then proceeded to point out the principles of successful merchandising, laying particular stress on the necessity of figuring profit on the selling price of the article and the importance of watching the turnover of the stock. At the conclusion of his address Mr. Hale brought out the necessity for more production on the part of every one and stated that the commission plan on sales or the payment of labor for piece work would add incentive to this.

HAPPENINGS IN THE INDUSTRY

REORGANIZATION OF CALIFORNIA-OREGON POWER COMPANY

A plan of reorganization for the California-Oregon Power Company has been decided upon by the bondholders committee of the company that will mean the formation of a new corporation. The plan is based upon the principle that the holders of five per cent company bonds of 1952 shall become the owners of the properties of the company, subject to the underlying bonds, and that the present common stock shall be eliminated. The new corporation will acquire the properties and assume the liabilities of the present company with the exception of the five per cent company bonds, and bonds of the face value of \$4,310,000 have been deposited with the Mercantile Trust Company of San Francisco to be used for the purchase of the new company, in exchange for their bonds; \$500 par value in preferred stock and \$1,000 par value of common stock being given in exchange for each \$1,000 bond plus all unpaid coupons. The new company will authorize a bond issue to provide new capital for improvements, extensions and betterments, and to provide the necessary funds for the expenses of reorganization and the payment of a dividend to non-assenting bond holders. The present underlying bonds will not be disturbed, but suitable provision will be made in the new bond issue for their refunding or exchange.

The company will authorize a bond issue of \$10,000,000 on the company's properties, subject to the underlying bonds, and there will presently be issued of these bonds \$3,000,000 face value. These will be used as follows:

For the refunding or exchange of underlying bonds.....	1,158,000
For sale to provide new capital, and to pay expenses of reorganization and dividend to non-assenting bondholders.....	1,842,000

The reorganization of the company will bring about a reduction in the outstanding securities of over six million dollars.

	Before	After
Underlying bonds	\$1,158,000	\$1,158,000
Company bonds	4,442,000	
Preferred stock		2,221,000
Common stock	8,283,000	4,442,000
	\$13,883,000	\$7,821,000

The securities of the company after reorganization will be supported by the properties of the company which at this time have a valuation of \$7,433,167.26. To this valuation will be added the value of additions and betterments resulting from the application of moneys resulting from the sale of the new bonds.

In 1918 the gross revenue of the company was \$502,-269.05 and the net revenue \$257,118.68, while in 1919 the gross revenue increased to \$726,079.30 and the net revenue to \$406,304.31. Since the first of this year the monthly net revenue has been over forty thousand dollars and the additional capital expenditures made with the funds provided by the sale of the new bonds will add to the electrical generating capacity of the company, and should result in an increase in the earnings of the company.

GREAT WESTERN POWER COMPANY ASKS FOR RATE INCREASE

The application of the Great Western Power Company for an increase in the electric rates to be charged over the entire system consisted principally of the submission of exhibits by the company tending to show that an increase in rates is necessary because of increased operating costs.

J. B. Black, sales manager of the power company, explained the exhibits as they were offered. He said that the total receipts of the company in 1919 were \$5,055,755. He estimated that the receipts for 1920, based on the present rates, would aggregate \$5,114,789.91. In 1919, one of Black's exhibits showed the company's total operating expense and depreciation footed up \$2,517,795, giving a net revenue after depreciation of \$2,537,960. The same exhibit estimated for 1920 a total operating and depreciation expense of \$3,296,928, leaving a net revenue after depreciation, if the present rates are continued, of \$1,807,870.91.

Black pointed out that according to the figures submitted by the company production expenses in 1920 would amount to \$1,525,268, or \$701,950 more than in 1919. The transmission expense in 1920, according to the company's estimate, would run to \$151,595, an amount \$22,010 in excess

The latest estimates made by the Power Administrator of the California Railroad Commission show a more favorable year for the hydroelectric generating plants of California and the irrigation of the valleys than anticipated a few months ago. The present prognostication indicates that during the months of July to November, inclusive, the shortage of water power will amount to 70 million kw-hr., distributed so that any one month will have not over 10 million kw-hr. shortage. Steam generation will give a total of 517 million kw-hr. during the last seven months of the year.



of the 1919 expense. Distribution expenses would total in 1920 \$58,822 more than in 1919. Taxes, said Black, would show a decrease of \$48,891, the company's estimate for this item totaling \$355,000 as against \$403,891 actually paid in 1919.

One of the company's exhibits showed an estimate of 112,737,560 kilowatt-hours of steam generated electric energy in 1920 as against a steam production of 41,757,450 kilowatt-hours in 1919. The same exhibit also showed that the company's hydroelectric production of 373,753,580 kw-hr. in 1919 would drop to 81,309,580 in 1920, due to low water conditions.

ACTIVITIES OF MONTANA RAILROAD COMMISSION

The engineers of the Montana Railroad Commission have for the past year been engaged on work that is in the nature of efficiency engineering, assisting the smaller utilities to readjust themselves to the present condition of high prices. By a study of the plants the commission engineers have found it possible to make recommendations that cut down the overhead expenses of the plant, and by changing operating conditions have made a rate increase unnecessary.

Since August of last year this commission has also been ex-officio the irrigation commission and the engineers have had to supervise the field work and assist in the formation of irrigation districts.

In rate cases the commission causes a physical valuation to be made whenever possible and during the past year valuations have been made of the following plants: Butte Electric Railway Company; Helena Gas Railway and Electric Company; Great Falls Gas Company; Billings Gas Company; Livingston Water Company, and about twenty other smaller water, electric and gas utilities.

Mr. James H. Bonner, chief engineer of the commission, has been making an extended study of the street railway problem and an article is being prepared by him on this subject that will appear in an early issue of the Journal of Electricity. The problems in Montana seem to be the same as those that confront the larger systems, namely, that the number of street car customers is decreasing at such a rate that increased rates do not compensate for the losses.

ELECTRICAL CONTRACTOR'S LICENSE FEE RAISED

The Board of Supervisors of the city of San Francisco have fixed the license fee of the electrical contractors at \$100. Heretofore the license fee has been \$10 a year, and various attempts were made at meetings of the Board of Supervisors to have the fee fixed at \$50 and \$75 a year. The larger fee was adopted by a vote of three to one.

SOUTHERN CALIFORNIA EDISON COMPANY STARTS CONSTRUCTION

On account of the immediate need for more power, there has been a departure from the original program of construction of the Southern California Edison Company for its Big Creek Project. The next unit of this development to be installed is the plant known as No. 8. This plant is located in Big Creek Canyon just below Plant No. 2, and will eventually receive the water from the San Joaquin River when the Mammoth Pool Tunnel is completed. It will also use the waters impounded in Shaver Lake after they have passed through the turbines now being installed at Plant No. 2. Bids have been asked for covering the hydraulic equipment, the first unit of which will be a 30,000-hp. Francis turbine to drive a 22,500-kilowatt generator. The plant will operate under a head of 700 feet. The generating voltage will be 11,000 volts and this will be raised to 150,000 volts for transmission to Los Angeles.

An interesting feature of the installation will be the construction of the transformers which are being built for 220,000 volts. It is later planned to change the entire Big Creek system to this higher voltage, as this particular plant can then be brought into service by simply changing the taps on the transformers. Preliminary work has been done on the tunnel and it is expected that a large crew will be engaged in a few weeks, as it is desired to have the new unit in operation for the summer load of 1921. This plant, with the additional machines now being installed in Plant No. 2 and the new plant on Kern River now nearing completion, will give the Edison Company 75,000 kilowatts capacity above what it now has.

IDAHO POWER COMPANY RATE INCREASE

The public utilities commission of Idaho, in a decision announced June 1st, granted the Idaho Power Company a 10 per cent increase over present rates for electric service in the state of Idaho.

In case of new contracts for irrigation service a 20 per cent increase is allowed, and it is pointed out by the commission that the hard law of necessity may demand a further increase on this item after the present year.

COMMITTEE TO CHANGE OVERHEAD CONSTRUCTION RULES

A committee has been appointed to change general order number 26 of the Railroad Commission, bringing it up to date and including in it the requirements of chapter 499 of the statutes of 1911 as amended by chapter 600 of the statutes of 1915. Seven years of experience have demonstrated that certain requirements of the order which relate to line construction should be revised and it is believed by the committee that all orders regarding overhead line construction should be under one cover. At a recent meeting at which all branches of the industry were represented it was decided that to get the best results a small committee should be appointed to carry on the work. The following committee was appointed:

Lloyd Henly, chairman, California Railroad Commission.
S. J. Lisberger, Pacific Gas & Electric Company.
R. E. Cunningham, Southern California Edison Company.
R. W. Mastick, Pacific Telephone & Telegraph Company.
H. B. Bell, San Francisco Oakland Terminal Railways.
F. E. Geigel, Southern Pacific Company.
J. E. Fifield, International Brotherhood Electrical Workers.
Arthur Kempston, Pacific Fire Extinguisher Company.
Carl A. Heinze, engineer electrical distribution, city of Los Angeles.
J. E. Macdonald, secretary, Joint Pole Committee, Los Angeles.

PASADENA TAKES OVER DISTRIBUTION SYSTEM IN CITY

The city of Pasadena has taken over the distribution system of the Southern California Edison Company within the limits of the municipality. This company has been in competition with the municipal plant and to remove this condition the city voted bonds with which to purchase the lines. The purchase price was \$533,262.33 and was authorized by the Railroad Commission.

IMPORTANT CONTRACT AWARDED

Los Angeles City, through its Bureau of Power and Light, has recently awarded two important contracts in connection with the further development of the aqueduct power, and with these awards definite steps have been taken for the construction of the San Fernando and Franklin Canyon plants. The General Electric Company was the successful bidder for the electrical equipment and S. Morgan Smith Company for the water wheels.

There will be two Francis type turbines, each of 45,000 horsepower capacity for the San Fernando unit. These will drive two 3500-kva. generators. At the Franklin Canyon plant there will be a 3500-horsepower turbine to drive a 2500-

kva. machine. The General Electric contract includes the complete equipment of generators, transformers, and switchboards.

The Bureau also announces that work will soon be started on a 20,000-horsepower unit connected with a 17,500-kva. generator at San Francisquito Plant Number Two.

CONSTRUCTION OF NEW LINE

Work will begin immediately on the construction of a 60,000-volt line from Green Point, the present terminus of the transmission line from the River Mill hydroelectric plant of the Portland Railway, Light and Power Company, to Station "B," the hydroelectric plant of this company situated at the falls in the Willamette River at Oregon City. A feature of the line will be a 500-foot span supported on steel towers over the Willamette River at Oregon City.

This new line will not only permit an interchange of current between the above-mentioned stations but will supply additional power to the Crown Willamette Paper Company for a new paper machine said to be one of the largest and finest in the country. The machine is equipped with individual motors on the rolls which are so connected and controlled that a change in relative speed of the rolls is impossible, thus preventing breaking of the paper.

HETCH HETCHY CONTRACT DECLARED LEGAL

Petitions to prevent the auditor of the city of San Francisco from paying \$276,000 to the Construction Company of North America as the first payment for construction work to be done by that company on the Hetch Hetchy project, were denied by Superior Judge Frank J. Murasky. Judge Murasky stated that the Board of Public Works had full power to award the contract to the Construction Company of North America, and to authorize the initial payment to bind the contract, and that the bond of the Construction Company to carry out the terms of the contract complied with all legal requirements. It was the contention of the tax payers who sought to stop the payment that the Board of Public Works and Board of Supervisors had exceeded their charter's jurisdiction when they awarded the contract to the Construction Company of North America and agreed to make an additional payment before the actual construction work began.

ELECTRICAL MANUFACTURERS' COUNCIL

The Electrical Manufacturers' Council has opened an office in the Fifth Avenue Guaranty Building, 522 Fifth Ave., New York. This office will serve as a headquarters for the Council and its work.

The Council coordinates the work of constituent organizations of the electrical manufacturing industry and its activities have been increased with the development of those organizations and the growth of the industry. The constituent organizations which have representatives on the Council are the Associated Manufacturers of Electrical Supplies, the Electrical Manufacturers' Club and the Electric Power Club.

EIGHT-CENT CARFARE ORDERED BY COMMISSION FOR PORTLAND RAILWAY, LIGHT & POWER CO.

Street car fares in Portland were advanced from 6 to 8 cents on June 15 upon order of the Public Service Commission of Oregon.

Original application for an increase in car fare to meet operating expenses and pay a reasonable return on the investment was made by the Portland Railway, Light & Power Company on August 15, 1919. During the fall a large amount of data was gathered and a thorough investigation of the company's receipts, expenditures and valuation was made. As a result of these studies the Commission came to the conclusion that either greater revenue or less expenses for the

company must be provided, and chose the latter method if it could be brought about.

The Commission pointed out to the City Commissioners of Portland the fallacy of imposing upon the company certain public charges, namely, bridge rentals, franchise taxes, car licenses, free transportation to city employes and paving charges, and recommended that the city, through the voters relieve the company of these burdens, and also suggested the purchase of the company's tracks in order to reduce the investment.

The city council declined to submit the proposal to buy the tracks upon advice of the city attorney that it would be unconstitutional, but did submit in the form of three measures the other recommendations of the Commission. These remedial measures were emphatically turned down at a special election, leaving the Commission no alternative but to increase the fare. The operating expenses for the company were shown to have amounted to over \$300,000 per month, of which \$255,000 is for payroll and \$16,000 taxes.

JOBBER'S AND LAMP MANAGERS' SALES MEETING

The Westinghouse Lamp Company in its policy to pursue and create a better cooperative spirit between its own organization and distributors of Westinghouse Mazda lamps, held a conference at its main plant at Bloomfield, N. J., on June 23, 24 and 25th. The subjects which were taken up for discussion were as follows:

The Aims and Purposes of the Jobber-Agents Lamp Managers' Meeting: W. T. Blackwell, assistant commercial engineer. Merchandising of Incandescent Lamps by the Electrical Dealers: S. A. Chase, Westinghouse Electric & Manufacturing Company. General Sales Policies of the Westinghouse Lamp Company: Elliot Reid, sales manager. New Incandescent Lamps and Their Fields of Application: A. R. Dennington, lamp application division. Testing Incandescent Lamps as a Check on Quality: H. S. Dunning, life test department. Engineering and Research Laboratories of the Westinghouse Lamp Company and Their Bearing on the Incandescent Lamp Industry: Dr. R. E. Myers, chief engineer. Industrial Lighting as a Field for Business Building: S. G. Hibben, district illuminating engineer. The Functions of the Branch Agents and Developing a Distribution System: W. W. Briggs, manager New York district office. Value of the Service Record: C. R. Ramsey. The Westinghouse Lamp Company's Plants and New Additions: H. S. Black, assistant general manager. Lamp Transportation Situation: G. C. Clark, transportation manager. How the Commercial Engineering Department Can Aid the Lamp Agent: W. T. Blackwell, assistant commercial engineer. How to Use the Advertising Service: F. W. Prince, advertising manager.

A discussion on Merchandising Incandescent Lamps and Handling Lamp Stocks by C. Beard, sales department, included the inspection of lamp exhibits which were made up of a number of exhibition devices that are used in the various electrical shows and conventions, and also a number of typical window displays for featuring incandescent lamps.

PACIFIC GAS & ELECTRIC BUY MORE WATER RIGHTS

Through the Mount Shasta Power Corporation, which is one of its subsidiaries, the Pacific Gas & Electric Company have sought the permission of the Railroad Commission of California to purchase the property and water rights on Fall river owned by the California Power and Manufacturing Company. Fall river is the principal tributary of Pit river and its main source of supply, and it is claimed by the Pacific Gas & Electric Company that the acquisition of these water rights will make most effective the use of the waters of Fall river and the early development of power on Fall and Pit rivers. The plans of the company call for the development of approximately 400,000 hp. on what will be known as the Pit river development, but which includes power houses on both the Pit and Fall rivers.

SAN FRANCISCO CONTRACTOR-DEALERS MOVE INTO NEW QUARTERS

On account of increased activities and an ever-increasing membership the San Francisco Association of Electrical Contractors and Dealers have moved from the Call Building and taken over the entire top floor of the Journal of Commerce Building, 163 Jesse Street.

BRITISH RAILROAD OFFICIALS INSPECT CHICAGO-MILWAUKEE ELECTRIFICATION

Sir Vincent Raven, chief mechanical engineer of the British railroad systems, accompanied by his chief designer, R. J. Robson and M. Lydal, consulting engineer, all of the London and Northeastern Railroad, have just completed a trip over the system of the Chicago, Milwaukee and St. Paul Railroad. The trip was made for the purpose of inspecting the recently completed electrification as the English railroad is considering the electrification of its lines to a greater extent than ever before. According to Sir Vincent Raven, at the present time there are seventy-four miles of electrified lines and plans have been made to start work at once on the electrification of one hundred and twenty miles of line. "The trip over the Cascades convinced the visiting engineers of the efficiency of the type of locomotive used by the Chicago-Milwaukee and without doubt this type of engine will be adopted by the English railroad. The visiting engineers were accompanied by H. E. Byram, president of the Chicago, Milwaukee and St. Paul Railroad, and by H. B. Earling, vice-president of the same line.

IS THIS ANOTHER FAKE ELECTRICAL DEVICE?

Letter to the Editor

Editor Journal of Electricity—Sir:

Referring to the matter of a stock selling scheme at Denver, Colorado, where a new generator is being exploited, alleged to produce twice as much light as any other generator with the same engine or engine power applied, I am pleased to present the following facts for general public information.

I have read a piece of literature put out by the Sethman Electric & Manufacturing Company of Denver, in which among other things it is stated this generator will cut the cost of fuel required for operation in half. The statement is also made that this generator will be universally adopted owing to its economy of operation and installation. If this generator will do one-tenth of what is claimed for it, I am sure you will agree with me that it should receive the recognition of the electrical press. If on the other hand it is a fraud, as I am thoroughly convinced, the electrical fraternity will also be very much interested, as considerable stock has been sold in this scheme, thereby affecting detrimentally the sale of securities in any bona fide electrical venture.

Mr. George H. Sethman, a consulting electrical engineer of Denver, is the inventor of the generator in question. A small shop has been set up on Tremont Street, Denver, in which some ten or twenty old induction motors of General Electric and Westinghouse manufacture have been disassembled and new windings inserted in the stator; the usual squirrel cage rotor has been replaced by salient pole field, and a small exciter made up for each outfit to furnish excitation for this field. It is claimed by the manufacturers that in each phase there is inserted suitable reactance capacity and short circuited coils to so modify the wave form produced by this machine that the first half of each cycle consists of a power impulse, as usual with 60 cycle machines, which takes full energy from the prime mover. It is claimed that with this new generator the last half of each cycle takes no power from the prime mover, but is a surge impulse created by the combination of capacity inductance and short circuited coils in the winding. The current is thus sustained through the electrical devices in its circuit without the expenditure of energy from the prime mover. The inventor, when asked by the writer how energy was again stored up in the inductance capacity and short circuited coil without detracting from the energy output on the next cycle, stated in a whisper that "right there was where Dr. Steinmetz fell down."

A demonstration is given by the inventor every other evening, in which one of the apparently convincing tests is to apply to one of the fields of a stationary machine 60 cycle current from the armature of another machine. By connecting different banks of lamps to different armature conductors on the stationary machine, and slowly turning by hand the field of this machine, the various banks of lamps are slowly lighted in rotation as the field passes by their armature coils. This demonstration is made out to prove that with the new generator in operation, no one light or electrical device on its circuits received energy all the time, thus cutting down the power input of the prime mover.

The generator is driven by a small gas engine which, it is stated, will at the altitude of Denver only carry half the load which is apparently caused by the lamps. Absolutely no instruments are connected into the circuit at any point nor will the inventor allow of such connection. Time and again efforts have been made by various parties, including the writer, to obtain some test at the demonstration room which would actually show the energy input into the generator, but despite numerous promises made by the inventor that proper arrangements would be made for such tests, it has never been possible for any outsider to obtain readings which would be of value in determining the actual merits of the machine.

In the discussion accompanying each demonstration the inventor claims that he is in continual correspondence with Dr. C. P. Steinmetz, and that some time ago Dr. Steinmetz gave him three afternoons for a discussion of the merits of this new machine. It is claimed that on the last afternoon Dr. Steinmetz practically gave up in despair, stating to the inventor that while he could not quite fathom all the mysteries of the machine, yet he could state that it was a most remarkable device. The writer wrote Dr. Steinmetz the above facts, and received a wire as follows from the Doctor himself:

"Never heard of Sethman and know nothing of the alleged facts."

The only installation of one of these machines which the writer was able to find was at Ault, Colorado, a small town which had installed this generator in its municipal pumping plant. The generator was run by belt from a jack shaft, from which were also running two of the city pumps. This jack shaft was driven by a large gas engine and there was absolutely no means of determining how much power was being delivered

to the generator by this engine. Notwithstanding this fact, great claims were made by the inventor as to the actual consumption of oil used in driving this engine and generator. About three months ago the writer went up to Ault and made careful tests on one of the circuits running off this machine, using a bank of lamps and instruments which had been carefully calibrated at the Denver Gas & Electric Company's laboratory at Denver. As was expected, there was absolutely no difference between energy input to these lamps at their normal voltage on this new generator and from an ordinary 60-cycle generator at Denver, or on a direct current machine of same voltage.

One laughable claim which has been made by the inventor was that with his generator only 1850 volts were necessary on the primary side of a standard 10 to 1, 2200 to 110/220-volt transformer, thus saving 350 volts, as he said. A small 10 to 1 transformer was taken to Ault by the writer, and of course it was found that 2200 volts was required to obtain 110/220 on the secondary side, even with the new generator and its peculiar wave shape.

The above facts were discussed by the writer with the District Attorney at Denver, and it was finally decided advisable to have the American Institute of Electrical Engineers initiate action against the inventor by confirming and publishing the above facts, thereby interesting stockholders to bring suit in their own behalf against the stock company promoting this scheme. The A. I. E. E. investigated the matter and wrote Dr. Sethman, demanding that he appear before them and explain his machine in detail, and that he allow tests to be made by the Institute, or they would take necessary action to have him expelled from the Institute for unethical conduct. No action was taken by Mr. Sethman which could be interpreted as an endeavor to "make good," and therefore on May 8, at a regular meeting of the Denver section of the A. I. E. E., a petition for Mr. Sethman's expulsion from the A. I. E. E. was signed and sent to the national headquarters. That same evening a letter was read before the Institute from Mr. Sethman, in which it was stated that the Denver section of the Institute had not treated Mr. Sethman properly, and its conduct had been such that he did not care to be associated with them any more, and therefore was sending in his resignation from the Institute.

A large amount of stock has been issued by the company promoting this generator, and from all the information which I have been able to gather, I believe it is conservative to state that at least \$100,000 worth has been sold. In fact, it is quite well understood in Denver that some \$200,000 worth of stock has been disposed of.

One of the most interesting phases of the investigation which I have made of this scheme is the ease with which such a scheme can be promoted among the more intelligent class of a community. Men who admit that they know absolutely nothing about electricity, and who usually can be credited with acting upon intelligent impulses, have without consultation with any one who understands electricity and its applications, purchased from \$1,000 to \$5,000 worth of stock in this generator. To put one's good money into the promotion of something about which you know nothing at all, seems to be such a common occurrence these days that several electrical men with whom I have discussed this scheme, have said: "Why bother your head, Smith, about such things? If the suckers don't put their money into this scheme, they will put it into another one, anyway. So what's the use of worrying your head about it?" I have heard the above statements so frequently during the past few months that it occurs to me the electrical press can well afford to bring this matter to the attention of the public. If in the particular case of the Sethman generator the press can be of assistance in running this matter down, and if it is a fake, they will materially assist in the promotion of any new electrical undertakings which deserve our support.

W. C. SMITH,
Transformer Sales Engineer,
General Electric Co., San Francisco.

June 17, 1920.

TRADE NOTES

New Sales Manager—

Schweitzer and Conrand, Inc., manufacturers of high voltage protective and switching equipment, of Chicago, announce that Mr. R. Roth, formerly of Lewis & Roth, Philadelphia, has come into their organization as sales manager.

New Engineering Firm Established—

Cope, Rand, Means Company is the name of a new engineering firm established by T. H. Means, irrigation engineer, and E. L. Cope, consulting engineer, both of San Francisco. Lieut.-Col. L. H. Rand, Engineer Corps, U. S. A., formerly at San Francisco and recently transferred to Camp Dodge, Iowa, also has an interest in the firm. Both Mr. Means and Mr. Cope have long maintained independent offices in San Francisco for consulting engineering work and are very well known throughout the state. Hydraulic and structural engineering is the specialty announced. The offices will be in the Holbrook Building.

Industrial Division Manager—

William R. Marshall has been appointed manager of the Industrial Division, New York office of the Westinghouse Electric & Manufacturing Company, to succeed Harlan A. Pratt, who has resigned to become sales manager of the Atlantic Elevator Company of New York.

Change of Ownership—

The plant of the Chase-Shawmut Company, Newburyport, Mass., has been purchased by Mr. Sears B. Condit, Jr., president of the Condit Electrical Manufacturing Company, South Boston, Mass.

LATEST IN EVERYTHING ELECTRICAL

(In mines which use direct current from a motor-generator set, the necessity of a switchboard operator can be eliminated by the use of the automatic control panel described on this page, since this makes possible the control of power from some remote point.—The Editor.)

AUTOMATIC CONTROL FOR MOTOR-GENERATOR SETS

In mines and other places where the direct current supply is obtained from a motor-generator set, it is frequently advantageous to control the power equipment from some remote point, thus eliminating the necessity of an attendant at the switchboard. Several mines are using with their motor-generator sets an automatic control panel, shown in the illustrations, which has all the protective features used in the small modern switchboard, and may be controlled from any remote point by means of an ordinary snap switch.



View of the board from the front, showing the circuit breakers and the oil switches, which consist of an operating magnet of the clapper type which is mounted on the supporting frame of the switch and drives the switch mechanism by means of a connecting rod extending through the top of the case.

This automatic equipment, which is manufactured by The Cutler-Hammer Manufacturing Company, consists of the necessary circuit breakers, switches, relays, fuses and recording instruments mounted on slate panels carried on a floor type frame. The primary equipment of the control panel shown in the illustrations consists of a hand operated oil circuit breaker provided with inverse time overload attachments, a phase failure and phase reversal relay, and an automatic starter of the auto-transformer type. This is to be used with induction motors, but the same general equipment with a few slight changes can be used with motors of the synchronous type. On the direct current side a knife switch, voltmeter and ammeter with the necessary fuses, and an automatic reclosing circuit breaker are provided.

With the remote control switch "on" the controller may be operated by merely closing the main line oil circuit breaker, or the breaker may be left closed and the equipment operated by means of the remote control switch. The closing of the main circuit breaker effects the closing of the phase failure and reversal relay, unless one or more of the phases are open or reversed, in which case the abnormal condition must be removed from the line before the relay will close. This relay has also the characteristics of a voltage relay, so the equipment will not operate if the line voltage is very low. After the relay closes, the automatic starter connects the motor through an oil switch to the low-voltage taps of an auto-transformer. When the equipment has come up to speed, the oil switch opens and a second oil switch connects the motor directly to the supply line, at the same time completing a circuit to the closing coil of the automatic reclosing circuit breaker, which immediately closes, establishing the generator voltage on the direct current feeders. In case of an overload on the direct current side, the circuit breaker opens, and recloses when the overload is removed. The oil switches used on this equipment consist of an operating magnet of the clapper type which is mounted on the supporting frame of the switch and drives the switch mechanism by means of a connecting rod extending through the top of the case. Both the stationary and moving contacts of the switch are carried on square insulated shafts and are easily accessible.

These control panels can be furnished in different capacities up to 300 kw. and, when so desired, can be built for operating two motor-generator sets in parallel.

BOOKS AND BULLETINS

The Engineering Index

One of the most useful and satisfactory of annual technical publications is the Engineering Index, the 1919 volume of which has just been issued. As a complete guide to the engineering literature of the year, it supplies a very definite need in the technical world, and its data is so arranged as to be accessible for easy and immediate reference.

This volume contains over 12,000 references to nearly 700 engineering and allied technical publications. It is thus a comprehensive guide to the engineering literature of 1919 and a book of considerable value to members of the profession.

Book on Water Power

A book on "Water Powers of Great Salt Lake Basin" is being compiled by Ralph S. Woolley, engineer of the United States Geological Survey. This is said to be the first book of its kind ever published. It will cover in detailed description the factors entering into the proper utilization of streams in Salt Lake and other valleys.

More than 60 per cent of the field work in connection with the gathering of the data has been done by Mr. Woolley, and nearly 15 per cent has already been written. It is expected that it will be completed this summer, after which it will be placed on file throughout the country as a reference on the Great Salt Lake basin. This book will contain a complete report of every stream, as to water power possibilities.

NEW ELECTRICAL DEVELOPMENT

(The Northwest reports plans for the construction of an enormous industrial plant on the Columbia river as a result of the signing of the water power bill, and also the construction of a power house in British Columbia, where 400,000 hp. will be developed. An encouraging report concerning water in the big Lake Spaulding reservoir is among other Pacific Central items and municipal purchase of an electrical distribution system is reported from the Southwest. Inter-mountain items contain reports of new power line construction, the installation of electrical mining equipment and plans for improved street lighting.—The Editor.)

THE PACIFIC NORTHWEST

TACOMA, WASH.—The council has passed an ordinance calling for street lamps on concrete posts on North 26th Street.

TACOMA, WASH.—The final step has been taken in authorization of the Lake Cushman power project, an ordinance having been introduced for condemnation of the property required.

KLAMATH FALLS, ORE.—Reorganization of Oregon-California Power Company will include floating a \$10,000,000 bond issue of which \$1,842,000 will be disposed of at once for improvements.

BELLINGHAM, WASH.—The Puget Sound Power & Light Company is to start at once laying double track on Cornfall avenue and doing other work in the nature of paving and so forth, at a cost of about \$40,000.

TACOMA, WASH.—The building of the Tacoma Railway & Power Company has been damaged by fire to the extent of \$60,000 and the heating plant of the Tacoma District Heating Company was also damaged to approximately the same extent.

KLAMATH FALLS, ORE.—The land owners of the Klamath Drainage District have instructed the directors to authorize the issuance of \$200,000 in bonds for the construction of a drainage system for the 20,000 acres of land in the district. The bonds bear 6 per cent interest, and extend over a period of 15 years. The first \$10,000 will be retired in five years.

SEATTLE, WASH.—Construction of two subways and an elevated trestle in the downtown district and reduction to a minimum and possibly the entire elimination of operation of surface cars in the business section of Second and Third avenues are features of recommendations soon to be made to the mayor and city council by the city engineering department.

SEATTLE, WASH.—Decision was reached by the council utilities committee to call upon the city engineer for a report as to the feasibility and safety of the plan submitted by Superintendent of the Lighting Department J. D. Ross, to develop hydroelectric power at Cedar Lake by construction of an 8500-ft. tunnel from the bottom of the lake to the power plant on Cedar river.

MEDFORD, ORE.—Bolen Creek Mining Company has filed application with the state engineer for permission to appropriate ten second-feet of water from Sucker Creek for the development of power for manufacturing lumber for power purposes. Canals, pipe line, water wheel and six miles of flume will be required. The estimated cost is \$8,000. Work is to start on October 1.

SEATTLE, WASH.—Declaring that many Seattle industries and most of 63,000 consumers of city light will be without electric current at the end of 40 days unless additional fuel oil for the Lake Union steam power plant is obtained, Superintendent J. D. Ross on June 19 asked the United States Shipping Board to furnish a tanker for use in transporting oil to Seattle for the city's use.

VANCOUVER, B. C.—Calling for the eventual expenditure of \$30,000,000, development of Bridge river power site near Lillooet is in its initial stages, surveying and preliminary work now being under way. Plans call for a tunnel

one and one-half miles long under Mission Mountain, discharging into Seaton Lake. The fall will be 1400 feet and the estimated horsepower to be developed is 400,000.

SPOKANE, WASH.—One of the largest projects of the West which will be developed as a result of the signing of the water power bill by President Wilson will be at Priest Rapids on the Columbia river in Washington, where H. J. Pearce and associates are planning to install an industrial plant. Initial investment will be \$5,000,000 but it will require three times this amount before the project is completed.

SEATTLE, WASH.—Seven-cent car fare has become effective on the Rainier Valley street car lines inside the city limits by order of the State Public Service Commission. The new schedule also includes elimination of commutation tickets to Renton, which have formerly been sold at the rate of two for 25 cents. The fare to Renton is now 15 cents straight. Fifteen-ticket tokens will be sold for \$1.00 but do not carry with them the transfer privilege.

SEATTLE, WASH.—The city council adopted Councilman William Hickman Moore's ordinance authorizing and directing Mayor Caldwell to investigate the \$15,000,000 traction deal and appropriating \$10,000 to defray the expense of the investigation. The ordinance was passed with an emergency clause attached, in which form approval by the mayor will be necessary in order to make the measure effective. Under the ordinance as passed, Mayor Caldwell will have free reins and the support of the council in his investigation of the negotiations leading up to the traction purchase.

SPOKANE, WASH.—Light and power rates to commercial users who use but a small amount of electricity are to be raised 50 per cent, according to a letter received by Mayor Fleming from the Public Service Commission. The proposed new schedule would become effective on July 15. Mayor Fleming indicated that there would probably be no protest to prevent the new rates going into effect as but few industrial users of power are concerned. Private homes are not concerned in any manner in the proposed increase. The rate affects all commercial accounts, including those of mercantile establishments, offices, public buildings, board and rooming houses and apartments where there is a master meter for all tenants. In commenting on the change Mayor Fleming said: "Unless something special comes up in regard to the change, we will not protest it. If those affected make a complaint it might be necessary to contest the proposed raise. However, unless this is done, it will go into effect. It is probable that there are too few affected to make a fight worth while when it is probable no results for the better could be gained by protest."

SEATTLE, WASH.—Mayor Hugh M. Caldwell of Seattle has signed the ordinance providing for a 6¼-cent and a 10-cent fare on city street cars, making the bill effective Monday, July 19, thirty days from the date of his approval. Although originally passed by the city council on July 14 as an emergency measure, to become effective on the Mayor's approval, Corporation Counsel Walter F. Meier has ruled that as it stands, it cannot become a law until a month has elapsed. The new fare provides for the

following rules on city cars: Ten cent cash fare; seven and one-half cent cash fare for each of two persons riding together; six and one-quarter cent metal tokens, each good for one fare, to be sold on all cars in lots of four for 25 cents, 8 for 50 cents, 16 for \$1, but not singly; free transfers with cash or token fares; three-cent fares for school children, except that two may ride for a nickel; ten school tokens for 25 cents. According to estimates prepared by General Superintendent D. W. Henderson of the street railway, the advance fares will result in an additional revenue of \$123,190 a month or \$1,478,280 a year, for the street railway. A supply of 2,000,000 metal tokens was ordered last week at a cost of \$17,000 and is now being made by Joseph Mayer Brothers, Inc., who agreed to furnish them in lots of 50,000 a day within three weeks.

THE PACIFIC CENTRAL DISTRICT

SAN FRANCISCO, CAL.—All but a small fraction of the Pacific Gas & Electric 7 per cent bonds have been sold.

MADERA, CAL.—F. M. Carter, recently with the Happy Valley irrigation district, has been appointed resident engineer for the Madera irrigation district.

SAN FRANCISCO, CAL.—The Pacific Gas & Electric Company declared its usual quarterly dividend of 1¼ per cent on common stock of record June 30, payable July 15.

VALLEJO, CAL.—The Vallejo Electric Light and Power Company has purchased the property opposite the new Virginia theater, known as lot 11, block 283. It is the plan of the electric company to erect a modern three-story electric light office building.

NAPA, CAL.—The city council passed a resolution authorizing the mayor and city attorney to negotiate with Oliver Hoffman for the purchase of his water rights in Milliken canyon, and to acquire his real estate known as the "Old Murray Place." This means Napa will have a municipal water plant.

REDDING, CAL.—The strike of electrical workers in the shops of the Pacific Gas & Electric Company, which was declared on May 27, ended when the foreman announced 36 of the strikers had returned to work. The balance of the men who quit are expected to return directly.

RED BLUFF, CAL.—A decision to submit a proposition for municipal ownership of the water system to the voters here was reached at the meeting of the city council recently. The movement follows in the wake of a raise in rates granted to the Antelope Creek and Red Bluff Water Company.

SAN FRANCISCO, CAL.—The Railroad Commission authorizes the East Bay Water Company to dispose of approximately 2000 acres of land in Contra Costa county owned by the company, but not needed in the operation of its water plant. The land is located in the vicinity of Pinole and San Pablo.

STOCKTON, CAL.—Provident Irrigation District emergency steam plant of 2,000 hp. capacity, to meet the power shortage of this summer in California, has been put into successful operation after a remarkably short time for construction work, which commenced April 1, 1920.

The plant is modern and complete in every respect and has been designed and installed under the direction of R. W. Van Norden, consulting engineer, and Leonard F. Yondall, contractor of Stockton, California.

MARYSVILLE, CAL.—A ranch completely operated by electricity is to be found in Garden valley at Camptonville, near here, according to Frank Gates, local Y. M. C. A. secretary, who returned from that place, where he has been preparing to establish the Y. M. C. A. summer camp. It is the ranch of Harold Nelson. Gates declared Nelson has all the machinery on the ranch operated by electricity, and that his home and outbuildings are brilliantly lighted. The power is obtained from a dynamo operated by a mountain stream.

SAN FRANCISCO, CAL.—Complaining that the Western Gas & Electric Company has invaded territory claimed by it, the Pacific Gas & Electric Company requested the Railroad Commission to forbid the Western company from constructing a 2300-volt service line in the so-called "Boggs Tract," west of the city of Stockton. The Pacific company alleges that the privilege of occupying this field of service was originally granted to the Oro Electric Corporation, which has been assimilated by the Pacific Gas & Electric system.

ALTA, CAL.—Notwithstanding all predictions of water shortage and drought which have been freely circulated, there now appears to be sufficient water impounded to furnish the normal demand this season. According to W. J. Eddy, superintendent of the Pacific Gas & Electric Company's ditches and reservoirs in the Drum district, the storage reservoirs at Lake Spaulding were spilling from May 20th until the early part of June. Eddy says the supply of water is as abundant as that of last year, and should last until late in October.

SAN FRANCISCO, CAL.—A complaint has been filed with the Railroad Commission by the city of Stockton against the Southern Pacific Company, Western Pacific Railroad Company, Santa Fe and the Stockton Electric Railroad Company asking that the railroad companies be required to build subways at a number of points in the city of Stockton. The complaint announces the purpose of the municipal government of Stockton to make preparations for a greater growth of the city by clearing the arteries of transportation of many grade crossings that at present involve delay as well as danger.

MADERA, CAL.—A dam for the Madera irrigation district will be designed by Louis C. Hill of the firm of Quinton, Code & Hill of Los Angeles, it was decided at a meeting of the directors of the district held recently with Mr. Hill and Thomas H. Means present. In the conference Mr. Hill again referred to the enormous cost of development which will result from the dam. He pointed out that the development of this power alone would justify the building of the dam if not a drop of water was to be used for irrigation purposes. From now on the work of development of the project will move rapidly.

SAN FRANCISCO, CAL.—Resolutions condemning the using of water from Lake Tahoe for irrigation purposes have been adopted by Pacific Parlor, No. 10, of the Native Sons of the Golden West. Copies of these resolutions are being forwarded to United States Senators and members of Congress and to magazines and newspapers throughout the country. The protest emphasizes the fact that there is an ample supply of water in this state for irrigation and power development without commercializing the beauty spots of California or lowering the water supply of natural wonders, which are being preserved for the public.

THE PACIFIC SOUTHWEST

LOS ANGELES, CAL.—Los Angeles Gas and Electric Company has been authorized by the Railroad Commission to issue and sell \$1,500,000

of its first and refunding mortgage 5 per cent bonds, due September 1, 1939.

PHOENIX, ARIZ.—The Salt River Valley Water Users' Association have passed a resolution authorizing the president of the association to enter into contracts with valley farmers to supply them with electricity wherever they will form into a district for community utilization of power.

LOS ANGELES, CAL.—A breakdown of some of the hydroelectric machinery at the Big Creek plant of the Southern California Edison Company near Huntington Lake, 20 miles east of Fresno, caused a 25-minute interruption in street car service on the lines of the Los Angeles Railway on June 22. A report that the trouble at the power plant was the result of a trembler was denied at the general offices of the Southern California Edison Company's plant.

TUCSON, ARIZ.—The electric district, organized for the distribution of power throughout the new pump irrigation area lying between Yuma and Dome, is rapidly becoming an accomplished fact. Pole lines are up, and the heavy copper transmission wires are being strung. Many wells and a few pumping plants are in readiness. More wells are being drilled and many pumps and motors have been contracted for. This is the first district organized under the electric district law passed by the last legislature.

PASADENA, CAL.—Transfer of the electrical distribution systems of the Southern California Edison Company in the city of Pasadena to the municipality for a consideration of \$533,262.33 was authorized in an order issued by the Railroad Commission. The deal by which the city was to remove its chief competitor to its municipal electric system has been in progress since April, 1918, and since that time Pasadena has bonded itself to provide the money for the purchase of the Edison system. The commission authorized the company and the city to execute the final agreement of sale.

PHOENIX, ARIZ.—Power from the Sierra Nevada Mountains of California is being used for the irrigation of ranches in the South Gila valley, ten miles east of Yuma, according to advices received at the Phoenix Chamber of Commerce. At present the largest development in this section is that of the 640-acre ranch of J. H. Maxey. But it is reported that within the next two years 20,000 acres will be under cultivation there. Cotton will be the crop. It is reported as a plan for the near future that this Sierra Nevada power will be extended to Gila Bend and thence to Ajo to supply electric energy to the New Cornelia and other mines of the Ajo district.

SANTA MARIA, CAL.—The Santa Maria Gas Company has been authorized by the Railroad Commission to acquire all properties of the Santa Maria Gas and Power Company and certain properties of the Midland Counties Public Service Corporation. According to the decision, the Santa Maria Gas Company is authorized to issue \$300,000 of stock, \$408,000 of 6 per cent 20-year bonds and \$82,000 of 6 per cent three-year notes to close the deal and unite the properties under one management. In acquiring the property of the Santa Maria Gas & Power Company the new company is to assume all the indebtedness of the old company and in addition to issue the old company \$300,000 of the new company's capital stock.

THE INTER-MOUNTAIN DISTRICT

BONNERS FERRY, IDA.—The matter of installing a lighting plant to cost about \$50,000 is being considered by the city council.

RUPERT, IDA.—Work is to start at once by Burley Electric Company on a new power line to be constructed north and west of town.

LOGAN, UTAH.—The 1000-horsepower irrigation pumping plant of Skeen & Skeen at Cache Junction is expected to be completed and in operation the first part of July.

HYRUM, UTAH.—The Hyrum municipal corporation has filed with the state engineer an application for the purpose of diverting one-half cubic foot of water from an unnamed spring in Cache county, the water to be used for power purposes.

SALT LAKE CITY, UTAH.—The topographical survey which was ordered by the U. S. Government in the various canyons in this vicinity is now in progress. This survey is for the purpose of determining the water possibilities and the probable power sites along a great portion of the western slope of the Wasatch Mountains. It will eventually take in most of the canyons from Ogden to Nephi.

BRIGHAM CITY, UTAH.—Negotiations have been completed whereby the Reclamation Power Company, which has a filing on the waters of Boxelder Creek at the highest point in Boxelder Canyon for power purposes, agrees to transfer all its right, title and interest, together with a right-of-way for pipe line and certain improvements already made on the pipe line to Brigham City for the sum of \$5,000.

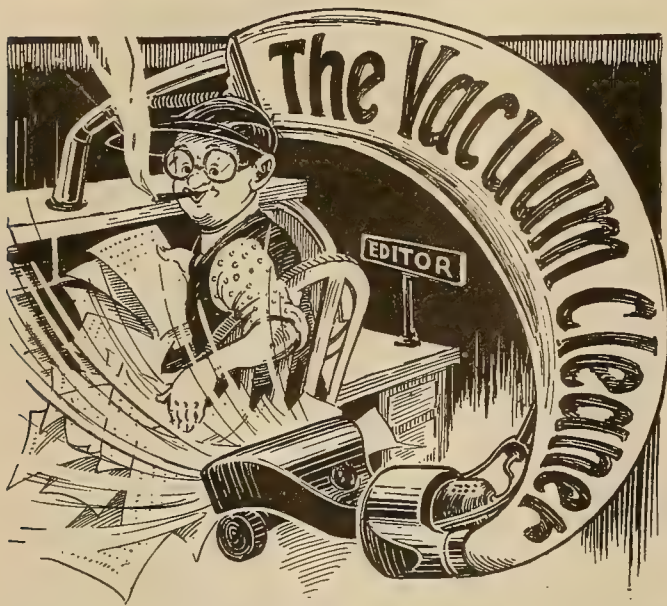
EUREKA, UTAH.—The Griggs-Huish Leasing Company has recently installed electrical equipment for the operation of their mill. This concentrating mill will handle large quantities of low-grade ore, as well as many thousands of tons of dump material which is valuable enough to be milled at a profit. The new mill has a capacity of 150 tons of ore per day, and on dump material, which will not require so much crushing, the capacity can perhaps be increased to nearly 200 tons.

POCATELLO, IDA.—The Ashton-St. Anthony Power Company won a decision in the district court at Blackfoot, Idaho, a few days ago, when the court refused to grant the petition of the Mackay Light & Power Company for a writ of review in a controversy which arose between the two electrical companies in the matter of furnishing electric power to the town of Arco. The town of Arco has entered into a contract with the Ashton company to furnish light for the municipality, and in a few days the line will reach that place.

OGDEN, UTAH.—Home gardeners are reported to be testing out pumps and other devices to get water to take the place of water from the city mains, use of which will be forbidden after July 1st by the city authorities to conserve the supply for household and industrial use. While some simple hand pumps have been installed by enthusiastic growers, others mechanically inclined have installed electric power for experimental purposes. Many by these means hope to carry through their plantings and reap the harvest of their labors.

SALT LAKE CITY, UTAH.—Definite action has just been taken by the city commission toward the creation of three new lighting districts that will give to three streets such lights as Main Street now has through the business district. The city attorney has been instructed to draw the necessary resolution to provide for the publication of notice of intention to establish the new districts. The systems will be the same as that on Main Street in lighting power, the difference being only in the standards, each of which will carry three lights, as do those on Main Street.

EUREKA, UTAH.—Rapid progress is being made by the Tintic Standard Mining Company in the construction of its new concentrator at Warm Creek, immediately east of Goshen. With a force of more than 200 men it is expected that the mill will be ready for operation by early fall. Two large transformers are now being placed in position on the hillside, and it will be a matter of only a short time until electric power will be available for operation of the tram, now under construction, to elevate minerals and supplies to the site of the mill, the foundations of which are now being set in concrete. Electric power is to be used extensively in all the mill operations.



Our Oriental residents are showing increased, more or less intelligent interest in the way this country is run. The following letter received by a Western editor is significant:

Dear Sir: What I write you please put in your Safety Valve. I am good, honorable Japanese boy, same as rest. I do good and spend money for industrios. Japanese boys good fellers, work and never do crime. Some people Sacramento try laws make agains Japanese always. Commissioner Cametti don't like Japanese much. Lots American do bad—steel, rob and do vice. I want no please why police don't arrest lot bad Americans and let Japanese lone. One Washington man, Thomas Marshall, President of the vice, i motion Grand honorable jury try him and stop it. Lots other Japanese boy think with me.

SHUMATE OMUKI.

* * *

Decisive refusals do away with all danger of backfire from the urgent agent. A bookseller recently had an "account rendered" returned to him with the following reply scrawled across the bill:

"Dear Sir: I never ordered this beastly book. If I did, you didn't send it. If you sent it, I never got it. If I got it, I paid for it. If I didn't I won't. Now you go hang yourself, you fathead. Yours very respectfully, John Jones."

* * *

An income often proves to be more trouble than it is worth. Why not, like Casey, be happy in the joys of freedom?

Michael: "An' phat are yez doin' wid thot incoom-tax paper, Casey?"

Casey: "Oi'm thryin' to figger out how much money Oi save by not havin' anny."

* * *

House hunting is rapidly becoming a serious matter in Western cities. One must ever be watchful for the golden opportunity.

Policeman, to prisoner who has just been sentenced to six months: "Excuse me, but do you want to let your house?"

* * *

THE LAST CHARGE

"Charge!" the young man said in haste,
 'Twas reckless he knew well.
 But no one stirred or moved a hand,
 Upon deaf ears it fell.
 It sickened him—he knew the cost,
 As o'er him crept a fear;
 His senses numbed—then came a voice:
 "Your credit's no good here."

WM. S. ALLEN.

THE LAST VETERAN

Shoes at fourteen dollars,
 Suits at sixty flat;
 Quarter each for collars,
 Seven bucks a hat.
 Overcoats a hundred,
 Milk two dimes a bowl,
 Swiftly are we sundered
 From our banking roll.
 Highballs—swallowed stealthy—
 Half a bone a nip;
 Golf is for the wealthy,
 So's the railroad trip.
 Sodas gone to double,
 Tax on movie shows,
 Figuring's no trouble
 Where the money goes.
 Rents up aviating,
 Smokes a nickel rise,
 Carfares extra rating,
 Added jits for pies;
 Wartime scales are noble,
 Sherman rang the bell—
 When do we demobil-
 Ize the H. C. L.? —E. S. MACKIE.

* * *

In Peru the natives have an interesting habit of utilizing the poles of the electric lines to cultivate the famous guguay moss which is fed to pet la Hyian goats. The milk obtained from these goats is used in the making of a cheese which is noted for its high ultimate strength.

* * *

Figures don't lie but some liars figure.

* * *



Among the most practical of electrical appliances is the electric curling iron which is shown in its most useful capacity above. Any who are skeptical of the value of this appliance may read of its less important uses on page 37 of this issue of the Journal.

THIS ISSUE: Increasing Production Through Adequate Illumination

JOURNAL OF ELECTRICITY

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Vol. 45, No. 2

SAN FRANCISCO, JULY 15, 1920

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JOURNAL OF ELECTRICITY

FOUNDED 1887

ROBERT SIBLEY, Editor

VOLUME 45

SAN FRANCISCO, JULY 15, 1920

NUMBER 2

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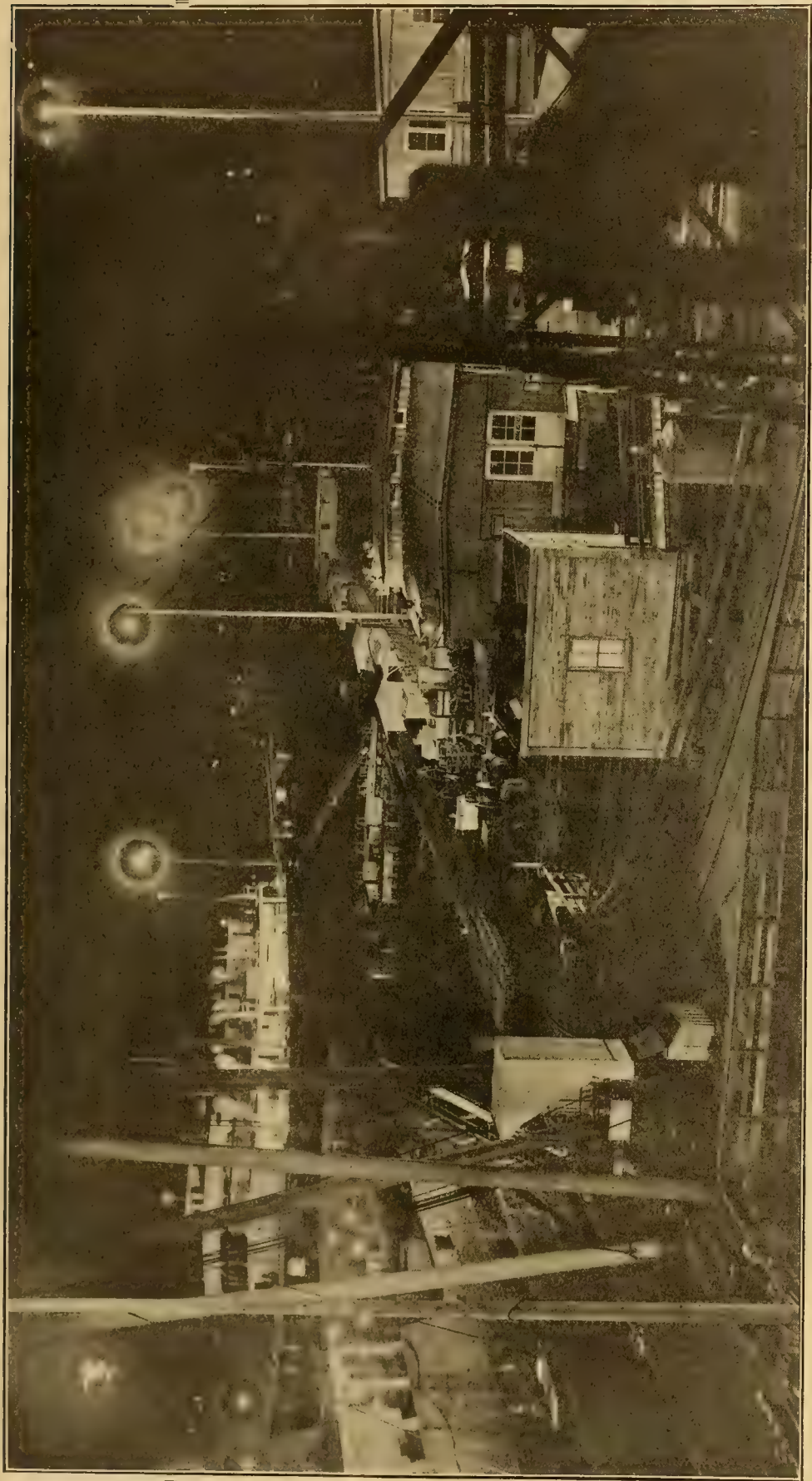
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THE ELECTRICAL TRIO:

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OUTDOOR INDUSTRIAL ILLUMINATION

THE adequate illumination of areas devoted to industrial activity has been and is to be in the future an important part of the great contribution of electricity to the progress of Western development. The necessities of the war and particularly the phenomenal growth of the shipbuilding industry of this coast taught many lessons in the practical value of proper lighting which are finding more and more extended application in peace times. The yard of the Southwestern Shipbuilding Company at East San Pedro, Cal., presents a notable example of illumination of outdoor spaces where active construction and assembly work is conducted even at night with high efficiency and without risk of personal injuries.



JOURNAL OF ELECTRICITY



DEVOTED TO THE UPBUILDING OF THE ELECTRICAL INDUSTRY IN THE WEST
AND IN THE COUNTRIES BORDERING THE GREAT PACIFIC

Volume 45

SAN FRANCISCO, JULY 15, 1920

Number 2

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LET THERE BE A LITTLE MORE LIGHT

BEFORE Adam's birthday the statement was made, "Let there be light." And, of course, there was. At least there was a certain amount, plenty to supply the primitive needs of the day. Work and play were during the daylight hours and there were no books to read at night. Later with more complicated, if not more enjoyable, living there was a growing need for more illumination. And, ever since, there has been the cry, "More light."

To trace the progress in illumination from the ages well named the "Dark Ages," to this, would be to follow the history of civilization itself. It is sufficient to say that every step in better lighting was a step of progress; either the better lighting caused the progress or progress demanded better illumination. It now appears that these two things are concurrent. Increased illumination of the home, the factory and the office makes for better, more efficient work, and better work demands more light. Realizing this, every aid should be rendered to further the efforts of those engineers who have assumed the burden of stimulating the use of increased illumination.

The outstanding feature of a discussion on inductive interference at the recent Pasadena Convention of the National Electric Light Association hinged about the point of public policy. Increasing voltages and instances in transmission of hydroelectric energy combined with the present state of flux in telephone evolution make the situation in connection with inductive interference more acute every day. Little evidence of a development of broad and intelligent policies on the part of power companies is to be seen in the nation today. On the other hand, the telephone company has instituted a clean-cut, definite policy which governs its actions throughout the nation.

It was, then, with great enthusiasm that the industry, through its representatives at the Pasadena Convention, listened to the remarks of John A. Britton, vice-president and general manager of the Pacific Gas & Electric Company, when he arraigned the power executives of the nation for not having instituted in the past more definite policies looking toward a successful and complete solution of the inductive interference between telephone and power lines. We hear much nowadays of the industry looking toward a closer cooperative action between merchandisers of electrical ware. Insofar as physical investigation and scientific research are concerned, perhaps no other instance stands out in the industry today more susceptible of cooperative treatment than that of inductive interference investigation. It is a problem in which the telephone company as well as the power company is concerned, and, in the advent of more extended railway electrification of steam railroads, a problem into which the railroads would also be ultimately drawn with no uncertain calling

of responsibility. It is, as a consequence, with no little emphasis that the Journal of Electricity would urge upon the industry, and particularly upon central stations, that this problem be given more emphasis in the near future. With the advent of vast interconnections of service, inductive interference will ever be with us, and, as a consequence, we must keep ahead of this problem or else unforeseen difficulties may arise which might prove extensive and embarrassing, and which may be avoided as the result of intelligent forethought.

It is possible only through a general survey of the entire field readily to grasp the rapid strides which are being made in the application of automatic apparatus in the generation, transmission and distribution of electric energy, particularly automatic sub-station installation.

Automatic Sub-Stations

The economies to be derived from automatic operation of sub-stations for the transformation and distribution of electric power for miscellaneous applications are now quite generally understood, and the apparatus for this purpose has reached a comparatively high state of development, although further simplification in details is highly desirable.

The application of automatic sub-stations to railway operation is of great significance in the West, as in some instances the economic margin between electrification of steam railroads or double tracking is so narrow that the cost of operating the sub-stations necessary for the electrification, together with the line losses in the low tension distribution, may be the determining factor in the case. An eminent authority on this subject has pointed out that the successful operation of automatic sub-stations

for this purpose has entirely changed the whole situation, since the automatic stations have such a decided advantage in operating costs, and the substations may be placed so much closer together that the low tension losses are also materially reduced. With this point in view it is of the utmost importance to the industry in the West to see that automatic apparatus is given the greatest encouragement possible.

The more or less isolated position of the engineering fraternity in the West, due to the great distances involved and the individual character of the problems which have developed in consequence and which are common to the district, has fostered the growth of local engineering centers in which engineers of all branches have joined together to meet common issues. The recent federation of national engineering and allied societies, plans for which were definitely made at the conference held at Washington, is therefore wholly in the spirit of western development.

The particular form and details of constitution of such an inter-organization are always open to individual comment, but the broad-minded attitude of give-and-take manifested by the parent societies at this joint meeting has started a nucleus of co-operation which is a safe basis for further development. The stand taken by the meeting that such a joint body shall represent the societies involved as units and not be a new organization formed from the individuals of all the groups, leaves the present associations without loss of the powers they now enjoy, in a position to cooperate in all matters of common interest.

The further development of this joint body which unites engineers, chemists, architects—in fact all professional men working toward the same end—is now in the hands of the individual organizations which shall uphold or disapprove the action of their delegates. The mere opportunity of working together, of standing together on public questions and of advertising professional men together in the mind of the public should be sufficient reason for neglecting any petty differences of opinion as to method and getting together on the reasonable basis now offered.

It is difficult to conceive of the rapid progress in lighting units and applications within the past few years. Almost immediately after one lighting unit is put into use another is developed and ready for the market, and it has been through only the most intensive education of the public that the demand for the improved units has been maintained. To maintain this demand, and to educate the public in the use of better illumination has been the function of the illumination engineers of the country. The scientific application of their art is most modern, while the art itself is most ancient.

As the principal tenets of the Illuminating Engineering Society are to conserve human vision, increase human efficiency and promote beauty, it is gratifying to note that the few dozen members of this society on the Pacific Coast are to form a branch in San Francisco in order that they may cooperate in the good work of forwarding these principles underlying better lighting, not only in the factory and the industrial plant but also in the shops and the homes. The Journal of Electricity wishes them the greatest success.

Fifteen thousand people visited the San Francisco Electrical Home during the two weeks immediately following its opening to the public. This means that fifteen thousand minds have changed their conception of what the words "electrical home" mean. Among other things, they have been impressed with the fact that the modern home must be equipped with thirty convenience outlets rather than with four or five, but they have been even more strongly impressed with the fact that beautiful and correct lighting stands out as more important than all other factors of interior decoration.

Up to this time the majority of home makers have not realized that the lights of their home go a long way toward determining their state of mind while within its walls. The average Western home is well lighted, to be sure, but men of the electrical industry are looking to more than this. Through such mediums as the above mentioned electrical home and others of its kind which are being planned in a number of California cities, the public is being shown that home lighting should be nothing less than excellent.

Through these model homes men of the electrical industry are demonstrating how the use of properly designed fixtures and appropriately colored lights can do more than any other feature to carry out the decorative scheme of a room. And further than that, they are demonstrating the fact that the right lamp in the right place can add immeasurably to the beauty of any room and even more to the comfort and convenience of the entire home. After seeing the harmony and beauty which are brought about in the specially planned electrical home, one cannot but realize the great service which will be rendered to the public and the increased profit which will come to the men of the electrical industry through the intelligent and unending cooperation of the electrical contractor, the architect and the home builder for the purpose of making the Western home the acme of beautiful interior illumination.

The wiring plan for a house or factory drawn up by the average architect can usually be interpreted in as many ways as there are contractors bidding on the job. This lack of clearness must be considered largely responsible for the great difference in the bids submitted by the contractors, according to the statement made by

National Society of Engineering Profession

Lighting the Home

A Solution of the Contractor's Problem

Forwarding Better Lighting

Romaine Myers, consulting engineer of Oakland, at the recent convention of the California State Association of Electrical Contractors and Dealers at San Jose. In cases where the wiring plan had been laid out by a competent engineer, Mr. Myers said, there is usually only five per cent difference between the high and low bids for that job.

It has been suggested by one of the contractors that a committee of contractors be appointed to meet with the electrical and mechanical engineers to try and find some means whereby all wiring plans will be laid out by competent engineers. If this plan can be carried out it will mean a saving in the cost of electrical installations because every contractor will know exactly what is to go into the job and can bid intelligently. With the present plans the contractor, to protect himself, must add a larger profit to cover the risk of being called upon to install something that was not clearly shown on the plan. Another advantage of this plan would be that adequate lighting would be assured to the customer, that there would be sufficient convenience outlets, and that the customer would know before the work was started exactly what it would cost, for there would be no excuse for extras, and exactly what the job would look like when it was finished.

The plan deserves careful consideration and should receive the attention not only of the engineers but of the contractors all over the country as a remedy for the differences in submitted bids which are misleading to the customer and harmful to the industry.

Now that industrial lighting and industrial installations of various sorts are being so actively discussed throughout the West, it behooves every member of the electrical industry to give serious thought to the question of new legislation along accident and industrial lines. Every commonwealth of the West is vitally interested in this subject, particularly California. A year and a half ago a bill which was designed to give broadened authority to the California Industrial Accident Commission was defeated in the California State Legislature. Every one believed in the general principles of the law, but there were many features that seemed undesirable, and, as a consequence, such leagues as the San Francisco Electrical Development League and the Los Angeles Electrical League aroused public sentiment so thoroughly that the bill was defeated. Nevertheless in the main, new legislation is desirable.

It is time, then, to undertake broad discussion of such problems as this. Institutions such as Development Leagues in various communities of the West should appoint committees to investigate these subjects, and see that the legislation has the backing of the electrical industry in every instance where constructive legislation is asked. There is a need for legislation in California, particularly with reference to inspection of pumping plants and suburban installations, and also with regard to the local inspectors having to pass state examinations. This is no time

to allow any selfish interests to thwart the passage of necessary legislation. Let the industry give prompt and broad consideration to this vital subject of the hour.

Even the casual observer must come to the conclusion that the pleasure car operated with gasoline is today in a critical situation. To thoughtful men of the electrical industry a new and pleasing vision comes to mind, namely, that the electrically propelled vehicle will again come into its own when developed to take the place of the gas operated car. So large and so vast are becoming the uses of gasoline in needed lines of national industrial development, that the thinking mind must come to the conclusion that sooner or later the pleasure car operated by gasoline must pass out of use. Inventors and those interested in research activities should give increased attention to the further development of the electrically propelled pleasure car, for now indeed it can render a real service to the country and furthermore there is all reason to believe that the present demand for this type of car will be permanent.

Practical results of a large outdoor lighting scheme such as those presented in this issue fill a real need. Many industries conduct their operations in the open or in such large interior areas that they come within the general character of the one described by Humphrey and Taplin and the specific kinds of apparatus found to give satisfactory results at San Pedro should be not only of value to illumination engineers but also to engineers who construct those projects which demand night work.

Of particular importance are the intensities used in this installation. One and a half foot-candles in those places where material is stored, and four and a half foot-candles where active work is performed have given good results in the production rates. Furthermore, no accidents have resulted due to insufficient light. This is one of the factors of prime importance and a cause of congratulation to the designers.

The need of proper lighting in industrial plants is now recognized by the majority of plant managers who are in the proper frame of mind right now to make any changes in lighting that will increase their production, cut down their spoilage and help to retard the number of accidents, which are always costly. With its large number of manufacturing plants which have heretofore received but little attention, the Pacific Coast is now ready to accept the latest improvements in industrial lighting.

The market is here, the customer ready and willing to be convinced and buy, and it only remains for the contractor to take advantage of this ready mar-

The New Accident Law

Illumination Outdoors

Industrial Lighting and the Contractor

ket. The market is here but the prospective customer has been educated by extensive publicity and will expect the contractor that comes after his business to be well posted on all of the latest ideas, and the contractor that can make the best selling talk will get the contract.

The contractor should go after this business but he should go well prepared with facts and figures, and he should not lose sight of the fact that he is a missionary of better lighting and as such he is helping to increase production, reduce waste and is insuring better working conditions for his fellow man.

Motion pictures have for some time been used as an effective advertising medium both by manufacturers and by such organizations as are devoted to the welfare of the entire industry. They are routed on the regular schedule of the theaters in the smaller towns and are much in demand by schools and organizations. Until recently, however, the idea has not been applied to the needs of the power company, except as all branches of the electrical industry are benefited by an increase of public good will toward any one of them. The motion picture "That Fairy in the Snowflake" which was a feature of the Pasadena convention was perhaps the first achievement along this line and is to go out to the public carrying with it an understanding of the fundamental principles which underlie the production of electricity, as well as some of the romance and dignity which underlie the industry. In a region which is to ask for \$700,000,000 for further electrical development within the next ten years, the value of this familiarity with processes on the part of the public is obvious.

A slightly different angle of approach has been followed by another western company which has made several thousand feet of reel covering the more personal side of the company's activities. The practice of "customer ownership" which originated in the West and which has perhaps found its widest application here, has already established friendly relations between power companies and the communities they serve. Such popular pictures as those now undertaken are destined to better this under-

standing into a real friendship which will prove invaluable as a basis for development and service.

The thoughts brought out so forcibly at the wonderful convention at Pasadena by the various reports of the National Electric Light Association committees cannot be too often recalled. The outstanding feature of the discussions was, of course, that the West is yet young in the electrical matters although it already leads the nation in the utilization of electrical devices and it has greater undeveloped possibilities for the economical generation of electrical energy than any other section of the country, or indeed for the whole of the other parts combined.

It follows that there would be no reason for considering these subjects unless the electrical energy had a useful application. A gigantic waterfall in a remote part of Africa, while of interest from a purely theoretical viewpoint, is not a thing that is often discussed by practical people; undeveloped coal mines in the interior of Siberia are not of general interest, but the hydroelectric possibilities of the West are neither remote from civilization nor in an undeveloped country. They are in the heart of one of the most productive sections of the world. Minerals are near at hand, rich land is waiting the hand of the agriculturist and here are ports through which the Far Eastern trade must pass, and, with these resources waiting, almost impatiently, the power now wasting will never need to hunt for a market.

It only requires a short trip through the various sections of the West to realize that the term "electrical West" is soundly given. Electrical power is the foremost force behind the tremendous development under way. In all parts the activity in all lines is impressive; new buildings are being constructed, many of them having only waited the development of electric power, and new farms are being plowed, certainly most of them having awaited the vitalizing force of electric power.

This is the electrical day of the West. And the message is going throughout the land with the result that the upward curve of development will incline ever higher.

The Demand for Technical Men

is growing so rapidly that making engineers has come to be one of the most important functions of an American university

The Student—The Professor—The Executive

will severally present their views on technical education in the August 1st issue of the Journal of Electricity

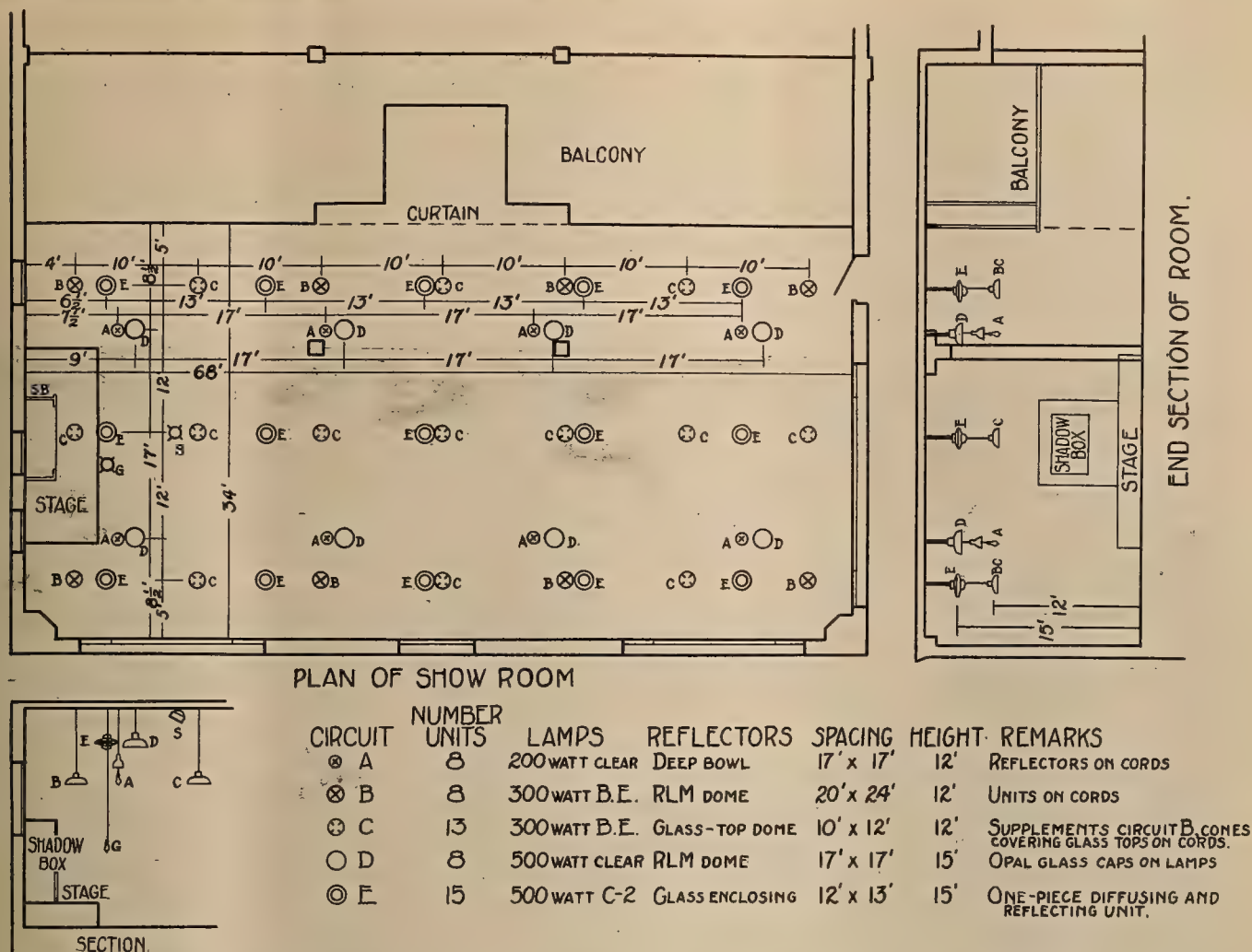


Fig. 1.—Plan and elevation of Demonstration Room showing lighting layout and type of units employed.

Seeing Is Believing

BY L. C. KENT

(Visual instruction is unusually pertinent when appertaining to illumination. No better way of showing the effects of better lighting can be followed than actually to show by demonstration the difference between good and poor illumination. The following article which treats of this subject is by a member of the Engineering Department of the National Lamp Works at Nela Park.—The Editor.)

“Seeing Is Believing” was the terse but comprehensive title of an industrial lighting demonstration staged under the auspices of the Lighting Sales Bureau of the N. E. L. A. at the recent convention in Pasadena.* The purpose of the demonstration was to show first of all to the Central Station executives what modern lighting has to offer in the way of rendering greater service to the consumer and of building the lighting load of the Central Station, and to show, further, the part a well worked out demonstration performs in carrying the message of lighting to the user of light. To say that the demonstration accomplished these objects is simply putting it mildly without any attempt to portray the enthusiasm which was manifested by those in attendance.

The past year fairly well marks the turning point in the lighting industry. Old standards of illumination practice have passed into the discard

and in their place have come new and higher standards, better equipment and application, all founded on the knowledge that illumination is something more than a hit-or-miss arrangement of light sources, that light is something which can be measured, controlled and directed efficiently down on the working area where the effect on the user of light should begin. By virtue of exhaustive tests in a number of industrial plants under actual working conditions, it has been demonstrated that the industrial illumination problem is one which vitally affects the earnings of a plant. By the use of proper and adequate illumination, production has increased—spoilage lessened and general all-around betterment of working conditions has resulted.

Technical societies and trade papers throughout the country have elaborated on the subject of "better" lighting. They have spread the doctrine of good lighting among thousands in industrial and commercial fields and have achieved as a result an awakened and widespread interest in illumination which has

*The booklet "Seeing Is Believing" issued by the Commercial Section, Division on Industrial Lighting of the Lighting Sales Bureau, offers the cooperation of the Bureau in working out and arranging a satisfactory demonstration under any specific local conditions.

been characterized as the New Era in Lighting. In dealing with intangible and impalpable things such as lighting is—or used to be—description and discussion alone cannot convey a full understanding and appreciation of the new standards in lighting. Its attributes and potentialities must be made known through demonstration. Good lighting must be seen, felt and experienced; it should be contrasted directly with conditions of the kind which still prevail generally. In this way, the Central Station representative realizes the truly enormous opportunity he has

Ward Harrison, well known in illuminating engineering circles, spoke at each meeting giving his interpretation of the considerations and various aspects of modern illumination practice. The lighting demonstration which was held in the Show Room of the Hotel Huntington Annex consisted of a number of different lighting systems on separate circuits, showing various types of reflectors at different spacing distances and mounting heights. With this arrangement, Mr. Harrison had at his disposal systems of various merit ranging from the poorest to the



Fig. 2.—General view of the Demonstration Room

to serve the industry, while at the same time multiplying several times the revenue from this load. By this means, also, the associated electrical interests of a given community can acquire the common understanding of the subject necessary to undertake a program through which the consumer will be adequately served with equipments of the proper kind, properly installed, and thus remove the limitations on the amount of light which the factory can profitably employ. And, finally, a demonstration forms, by all odds, the most effective sales method. It offers the opportunity of arousing the interest and of educating not only officials of individual plants, but also entire engineering, trade and business organizations.

ideal, which could be switched on and synchronized, as it were, with his talk, thus driving home all of the salient features of illuminating engineering practice.

Figure 1 shows a plan and elevation of the demonstration room, showing locations of the outlets together with the fixtures on each circuit. Fig. 2 is an interior view of the room with the various systems turned on. On the tables at which the audience sat were placed foot-candle meters for measuring the illumination, bright tinned pans and lids for observing reflected images of light sources, and castings of such complication as to indicate the shadow conditions. In this way they were able to compare the various systems and types of lighting units, to see

for themselves that glare and reflected glare are something more than technicalities and that they should be eliminated, to observe that correct spacing units insures uniformity of illumination, to learn something of color quality and light direction, and finally, that the phrase "too much light" has its origin in "too much glare."

Figure 3 shows a close-up view of the stage. A small platform was erected across the front of the room and the control of all lighting units brought to a switchboard at this point. A rheostat in the main

modified as to reduce the gradation in size between rows of letters, stood on a table. In addition there was provided a shutter-like device for "instantaneously" exposing a desired letter or group of letters to view.

At one side of the stage was a row of lamps with clear bulbs, diffusing bulbs, diffusing globes, etc., for use in analyzing glare. Near this was placed a chart with lettering of various sizes and near the bottom a circular opening behind which was placed a 300-watt all-frosted lamp connected with a rheostat.

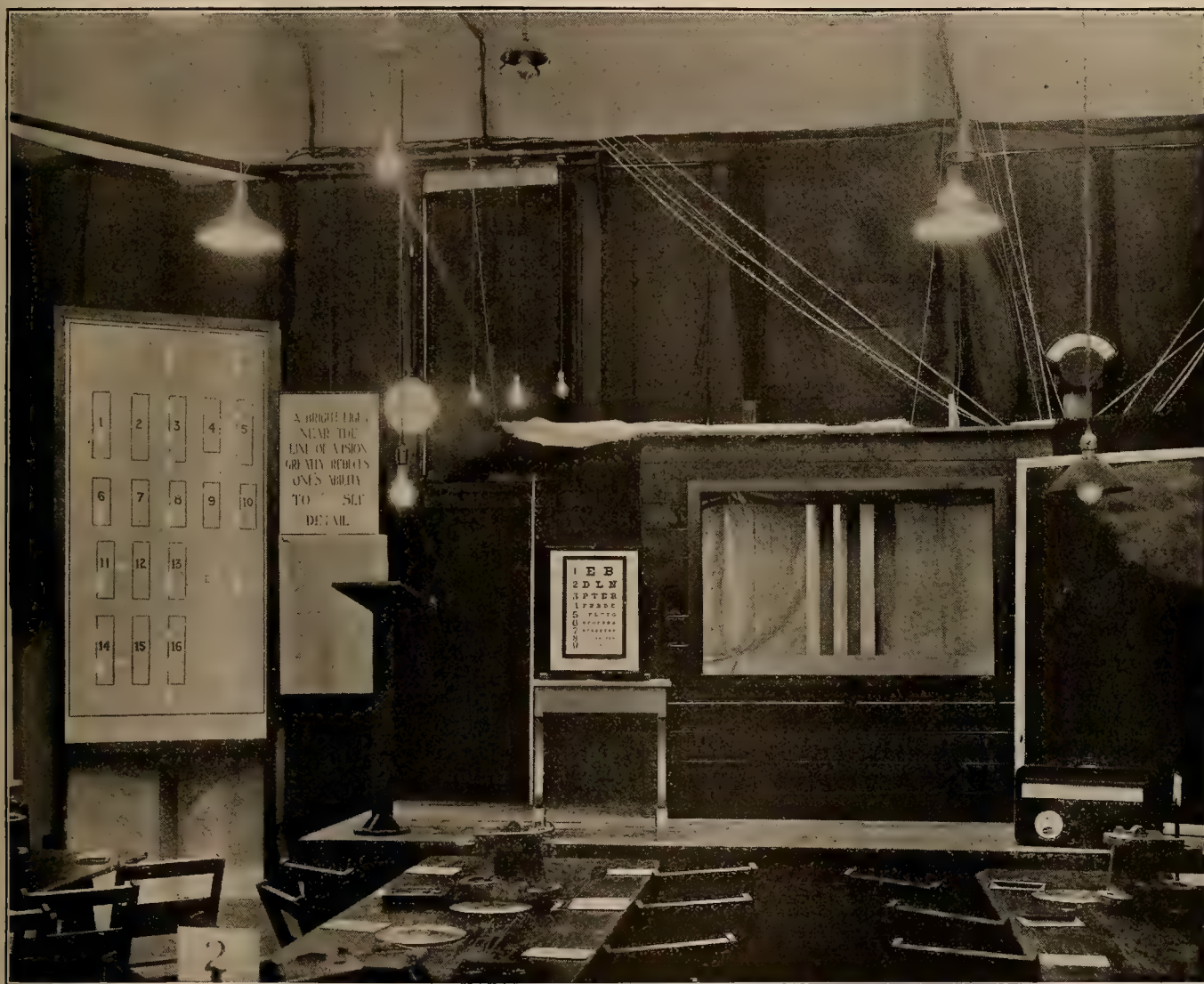


Fig. 3.—View of stage showing apparatus in illustrating the various illumination principles.

circuit permitted a reduction of voltage of the various systems to a large range below normal. At the back of the platform was a long box lined with cloth and open at the front, in which were three vertical wooden bars of different cross sections, and lighting circuits providing illumination from any or all directions. A screen for the projection of lantern slides was placed above this box.

Above and to the front of the stage was mounted a 200-watt floodlight with its beam directed on the stage. A rheostat was placed in series with this lamp so that the intensity of illumination on the stage could be varied at will.

A large card in the form of a Snellen Chart, so

A large chart showing a plan view of the room with the different systems of lighting and indicating the position of the various tables was available in discussing the results obtained. A blackboard completed the platform equipment. With the above mentioned equipment at hand, the speaker had facilities for outlining to his audience the steps in illumination design, illustrating the conditions to be avoided as well as pointing out the essentials of every good illumination system.

Taking up first the elementary considerations in the design of a lighting system for the demonstrating room, Mr. Harrison turned on a system of bare lamps, but due to the large amount of lighting strik-

ing the walls and ceiling, the intensity as read by the foot-candle meters on the tables was far short of that which he set out to get. Reflectors were then lowered over the lamps and the intensity again read. With the reflectors, greatly increased foot-candle values were obtained. Glare from unshaded light sources was illustrated by the bare lamps, contrasted with the results when the reflectors were lowered over the lamps.

Non-uniformity resulting from too wide spacing of units for a given mounting height was indicated by a system, otherwise very good, but where the illumination directly under the units was found to be five or six times that midway between lamps. Substantially uniform illumination was obtained by the same number of units mounted higher. At the lower mounting height, however, with a closer spacing of units, uniform illumination was obtained.

The superiority of dome reflectors over deep bowl reflectors in illuminating vertical surfaces as well as softening shadows was observed by viewing the castings on the tables when each system was turned on.

The general impression produced by different types of lighting installations was noted in comparing the dark ceilings and walls characteristic with deep bowl reflectors, the better illumination of side walls with dome reflectors, the improved illumination of ceiling as well as walls with glass top dome reflectors, and the attractive appearance of ceilings, walls and the units themselves, when the glass enclosing units were employed.

Illumination calculations always take into account the color of walls and ceilings, and, to demonstrate the significance of this factor, the walls of one-half of the room were draped with dark cloth having a refraction factor of about 15% while the other half was covered with light colored cloth which reflected approximately 60% of the light. The foot-candle meter readings in that part of the room surrounded by dark walls were noticeably lower than in the part where the walls reflected the greater part of the light.

That color quality of light has a great deal to do with the effectiveness of a lighting system was demonstrated by one system using daylight lamps. Not only was color identity and identification of objects with the whiter light more marked, but also the light mixed well with daylight, as was clearly observed when the curtains were drawn from the windows.

The effect of undervoltage burning of lamps was clearly demonstrated by noting the foot-candle meter readings when the lamps were burning at full voltage and when the voltage was reduced.

As a fitting climax to the general lighting demonstration, all the systems were turned on simultaneously, flooding the room with light giving an intensity of over 70 foot-candles, revealing all details of objects perfectly with entire comfort to the audience. The popular fallacy of "too much light" was shown to result from the use of units which cause glare.

Much has been written on the value of good lighting and higher intensities in increasing production, reducing accidents, etc., but as the eye apparently functions well over such an enormous range of

intensities, it is hard to conceive just how these things come about. Mr. Harrison showed in a convincing manner that visual acuity is dependent upon light intensity and also that there is such a thing as the time element in vision. The modified Snellen Chart was first illuminated to an intensity of the order of $1\frac{1}{2}$ to 2 foot-candles, and then to 12 to 15 foot-candles. Under the latter illumination, an additional line or two could be read from any point in the room. The apparatus for exposing letters for short intervals was so adjusted that under an intensity of $1\frac{1}{2}$ to 2 foot-candles the letter could not be identified from most parts of the room, whereas when exposed for the same interval under an illumination of 12 to 15 foot-candles it was easily read. It was shown by these two demonstrations that under adequate lighting one sees more and sees more quickly, and is therefore able to proceed with his work more accurately, and also more quickly, or with less fatigue. It became evident that good lighting is a part of the safety equipment of an industrial plant.

The importance of differences in brightness, that is, light and shade, in revealing the form of objects was portrayed when the three wooden bars in the shadow box were illuminated from different directions. Their appearance was substantially identical when illuminated equally from four sides, but with the light largely directed from one side, they stood out distinctly as being round, square and flat.

Glare has long been felt by illuminating engineers to be the greatest drawback to proper illumination, although the popular mind has never been able to picture and conceive of its harmful and insidious effects. Glare manifests itself in numerous ways and should be guarded against as much as possible by fool-proof units.

By increasing the voltage on the lamp behind the glare chart, the smaller letters near the bright spot became obliterated, evidencing the truth of the statement carried on the chart, "A bright light near the line of vision greatly reduces one's ability to see detail." As the brightness was further increased the chart could be viewed only with discomfort. Thus the effects of glare, both in interfering with vision and in causing discomfort, were emphasized. The effect of the position of the light source with respect to the eye was indicated by raising and lowering a bare lamp above the platform.

Reflected glare from bright surfaces was apparent in the tinned pans. The value of the bowl-enameled lamp and the enclosed diffusing unit in minimizing the effects of such images of the units was clearly demonstrated.

Lantern slides were used in emphasizing the importance of maintenance for lighting systems, as well as in the direction of other points.

It is believed that demonstrations of this character in cities throughout the country is a sure means of popularizing lighting to such extent that factory managers will be able not only to analyze their own lighting problems and to safeguard themselves from inadequate and improper illumination, but also to recognize and take advantage of the possibilities for profiting through light applied as a definite part of the producing equipment of the plant.



Panorama of Southwestern Ship Yard showing angle park and outfitting yard.

Industrial Yard Lighting

BY A. G. HUMPHREY AND R. G. TAPLIN

(Exact methods of installing lighting equipment for the illumination of large outdoor spaces are here described by Humphrey and Taplin, electrical engineer and industrial engineer respectively, of the Southwestern Shipbuilding Company of San Pedro, California.—The Editor.)

In an industrial plant where large outdoor areas are in use for storage and for processing, such as the fabrication and assembly of structural materials, it is essential, if the daily production is to be continuous through two or three shifts, that the yard areas be adequately lighted. In designing an installation under such circumstances three principal factors must be the basis: first, the provision of a fair amount of light throughout the storage areas; second, such intensity of illumination at the working plane in the fabricating and assembly areas as will promote the maximum efficiency of the men at work, and such distribution as to eliminate shadows and dark spots; third, the creation of flooded areas where more intense illumination is required, or where it is not practicable to erect lighting poles or standards.

In the construction of the plant of the Southwestern Shipbuilding Company, at East San Pedro, California, the above requirements were well exemplified, for here, due to the climatic conditions, a large proportion of the punching, shearing and bending, and practically all the fabricating and assembling, are accomplished in the open. In this plant the requirements were met by the use of high poles, angle reflectors on the walls of the buildings of sufficient height and flood lights set on towers or stands on the roofs of buildings.

Poles are located in the steel storage area, the "Angle Park," where punching and bending are done, and at such other locations as would not interfere with the movement of materials. These poles are fir sticks, ranging in length from 65 to 100 feet, and set in concrete footings to a maximum of 8 feet below the yard grade. Feeders to these poles are three number ten rubber covered wires laid in one-inch metal conduit at an elevation of about 1.5 feet below grade, where they enter 30-ampere, 250-volt, three pole, single throw, fused, Square D switches. From these switches the wires are continued up the

poles in three-quarter inch conduit to Type F-2 conduit bodies with three-hole porcelain covers. One foot below the top of each pole are placed four branch arms of one-half inch conduit, each extending three feet from the pole and ending in a gooseneck. These branch arms are erected in pairs, each pair passing through the pole, and each provided with one C-1 conduit body with porcelain cover, located close to the pole, the two condulets being in the arms adjacent to the feeder. The wires are carried from the F-2 conduit to the branches through the C-1 condulets, one side of the three-wire circuit feeding two lamps through each pair of branch arms. On the other end of each branch arm are located one X5509, Benjamin, shallow bowl, mogul base, distributing type reflector, with a 400-watt Mazda C lamp, giving a total of four lamps and 1600 watts per pole.

These poles are so distributed as to give an average of 1 foot-candle intensity on a plane 3 feet above the yard grade in the storage area and 1.5 foot-candles in the "Angle Park" working area. Further intensity was provided at each machine by means of individual, low wattage lamps, both fixed and portable, as circumstances required.

It will be noted from the foregoing that each pole is separately controlled through a Square D switch. This provides a very flexible arrangement, making it possible to reduce, at will, the number of units in service. When the working force is reduced to one or two shifts only such poles are used as are required to provide general illumination.

The general illumination of the Outfitting Wharf is provided for by poles similar to those in use in the yard. This wharf is 1100 feet in length and is served by six poles each 90 feet long. These poles are jettied into the bay along the shore side of the wharf and tied to the main wharf piling by bolts and U clamps. Each is provided with one number 1203, Benjamin, multiple street lighting unit, mogul

base, and a 400-watt Mazda C lamp, mounted on a one-half inch conduit, goose-neck bracket, with the lamp 2.5 feet from the face of the pole and 55 feet above the wharf deck. The lamps are fed from two number 12, rubber-covered wires, laid in one-half in.



Plate shed illuminated from angle reflectors and floodlight towers.

conduit and controlled by a 30-ampere, 250-volt, three-pole, single throw, Square D switch set on the pole.

Between the Plate Shed and the Slipways is an area approximately 600 feet long and 80 feet wide. Forty feet of this width, extending from the Plate Shed to a standard gauge track, is used for the assembly of girders, columns, etc. This area is lighted by 400-watt Mazda C lamps in number 5537 Benjamin angle reflectors, spaced 22 feet centers along the wall of the Plate Shed at a height of 32 feet above the ground. There are 24 of these units, controlled by six 30-ampere, 250-volt, Square D switches mounted on the timber columns of the Plate Shed. The in-

tensity of illumination in this area is 4.5 foot-candles at a point 25 feet from the building.

Located on the roof of the Plate Shed are four timber framed towers, on each of which are set three 500-watt Davis flood lights each containing a 400-watt Mazda C lamp. These lamps are so set as to flood the areas adjacent to and between the heads of the six shipways and give most excellent and satisfactory illumination to this space, as well as providing general illumination along the length of the passage ways and steel plate storage racks between slips.

Local illumination on the shipways is provided by 100-watt lamps in shallow bowl, steel enameled reflectors set on 4 x 4 in. posts above the staging, and by strings of 60-watt Mazda C lamps in weatherproof "shurlok" sockets strung on weatherproof wire. By these means all parts of the staging and the decks of building vessels are adequately lighted and the possibility of injury is reduced to a minimum.

Protective lighting was provided during the period of the war by four searchlights of 500 and 1000 watts capacity, set in timber towers located at such points as to permit the guarding of all approaches to the plant. For this purpose were used Davis flood light units with searchlight reflectors, so mounted on swivel bases as to sweep the entire property line at will. The searchlight towers are fed by a three-wire, 220/110 volt circuit. The lamps are fed from either side of this circuit through a switch so arranged that should the fuses blow on one side the other side can be thrown into service. In addition to these towers, 500-watt Davis flood lights, with 400-watt Mazda C lamps, were mounted on stands or brackets on the roofs or walls of several of the buildings so as to flood the areas adjacent to the entrance to the yard, both inside and out, the sides of the vessels being outfitted, and certain portions of the yard where special illumination was required, as the plate storage areas, where plates were loaded or unloaded.



Above is shown the use of angle reflectors to illuminate a long narrow way not used for active construction work, and to the right a general view of a portion of the angle park illuminated from high standards on each of which are mounted four reflectors each containing a 400-watt Mazda C lamp.



On each of the seven cranes, of the tower type, the boom carries special brackets with four dome reflectors, in each of which is a 400-watt Mazda C lamp, thus providing adequate local illumination for the handling of fabricated sections, plates and machinery to the hulls. On each side of the crane cab



Engineering department offices and slipways. General lighting from mast lights.

is attached an angle reflector, so placed as to light the crane tracks.

This briefly outlined lighting scheme was the result of a careful study of the general layout of the plant, and the selection of equipment which appeared best adapted to the service demanded. The result was a well balanced and most adequate illumination of the entire yard for all purposes, and provided a generous and economical amount of light to all working areas, and accomplished the measure of protection deemed necessary. No accidents due to lack of sufficient lights have occurred, and night work has proceeded at the maximum of efficiency and without complaint insofar as illumination was concerned.

The maintenance of the equipment has been found to be a minimum due to the sturdy nature of the installation. No difficulty has been experienced with the conduit work, and this has contributed largely to the minimizing of interruptions which would have caused expensive loss of time.

The Foot-Candle Meter and Its Part in Better Lighting

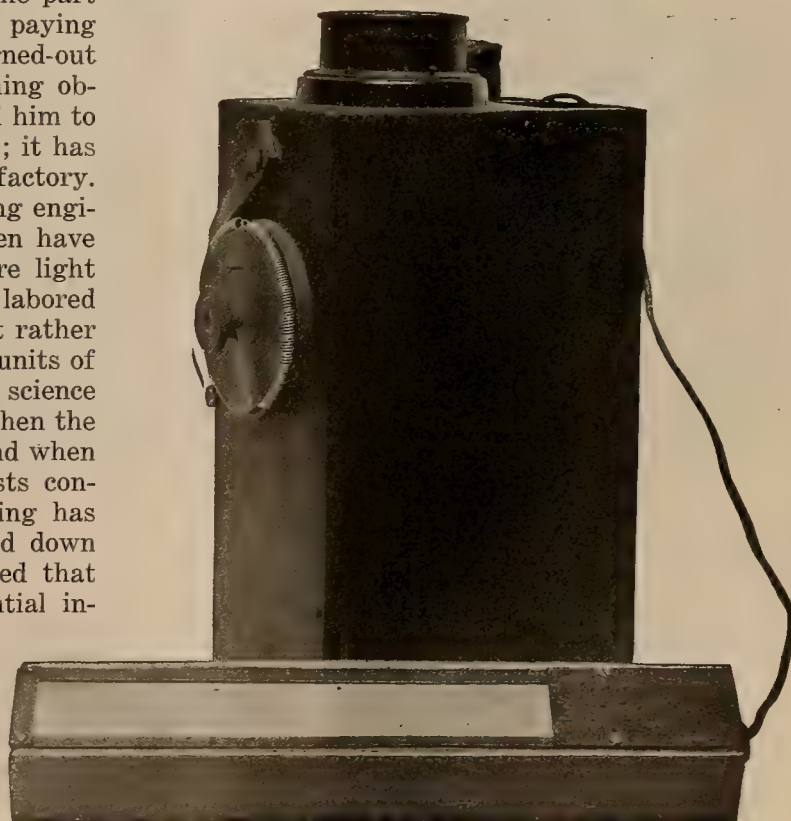
BY W. M. ROSBOROUGH

(To educate the public in the terminology of illumination required that a means of easily and quickly measuring light be evolved. The result of the researches was the Foot-Candle meter which is here described by the assistant to the Pacific Coast manager of the National Lamp Works of the General Electric Company.—The Editor.)

There is a general recognition in lighting circles of the fact that illumination has assumed a new status. We have had electric lighting in our industrial plants for many years, as well as in our stores, our offices, and homes, but the interest on the part of the user has not extended far beyond the paying of the monthly bill or the renewing of a burned-out lamp. To him, light has been light, something obtained at the snap of a switch; it has enabled him to see and that is as much as he cared about it; it has been satisfactory or it has been unsatisfactory. Gradually, however, the efforts of illuminating engineers have been bringing results. These men have long recognized the distinction between mere light and real illumination. They have consistently labored to interest the purchaser in buying an effect rather than a cause. They have established simple units of light measurement and have reduced to a science those things that happen between the time when the light leaves the lamp as candles or lumens and when it registers its impression on the eye. Tests conducted in industrial plants where the lighting has been planned according to the principles laid down by these illuminating engineers have proved that their theories are correct and that substantial increases in production may be obtained at extremely small increases in the cost of plant operation by substituting adequate illumination for poor or mediocre lighting. The progressive factory manager now regards lighting as something which he can use to very positive advantage rather than as an unwelcome necessity which he is

forced to tolerate. It has become in his mind a definite part of the producing equipment of the plant.

It has taken years for the appreciation of lighting to grow to its present proportions, and there are



The first foot-candle meter.

no doubt many reasons why this has been the case. One of the chief reasons has been, however, that light has not been readily measurable; it has been difficult to compare the illumination in different plants or between different sections of the same plant. It has been correspondingly difficult to evaluate the effect of lighting in increasing production, decreasing the accident hazard, improving the qual-



The meter with leather carrying case

ity of the product, and improving the morale of the operatives, because the basis for comparison has been lacking. It is true that light measuring instruments have long been available but these have been complicated, from the standpoint of the layman, and they have not been adapted for convenient use. The development of the foot-candle meter, which measures light almost as readily as a thermometer meas-

by means of a leather strap handle the whole outfit could be carried around as easily as the ordinary electrician's set. Fig. 1 shows the construction of the first foot-candle meter. This instrument was quite satisfactory for a beginning. The little light box could be placed in any position and could be controlled from the battery box. The whole apparatus, however, was rather heavy and lacked the convenience and portability features so essential to making it truly successful.

From time to time, changes in design were made for the purpose of making the instrument lighter and more compact. By rearranging the parts and substituting lighter materials, the present model, as shown herewith, was produced. It is the result of very earnest efforts to develop a neat, portable photometer, reasonable in price and accurate enough for most purposes. The utility of an instrument of this kind is great; at the time of this writing approximately 3000 foot-candle meters are in service and the demand for them is growing constantly.

An important and far-reaching result of the use of this instrument, already becoming apparent, is in its inducement to form the habit of thinking in terms of foot-candles. It is the common practice for the butcher to "heft" a roast and to estimate its weight before placing it on the scales. He takes pride in his ability to estimate weight, for a knowledge of weights and measures is part of his stock in trade. Knowledge of illumination values is part of the light-



The foot-candle meter in its present form



The foot-candle meter measures light at the work

ures temperature, has placed the means for measuring light within the reach of the plant executive himself and the manner in which he has taken to it is evidence of the satisfactory manner in which it is filling a real need.

The first instrument that was called a foot-candle meter consisted of a box which contained a battery, rheostat and voltmeter, and a test or light box comprising the scale with its translucent holes and a little miniature lamp. This light box was entirely separate from the battery box, but electrically connected to it by a flexible cable. The battery box had a compartment for carrying the little light box;

ing man's stock in trade. With the foot-candle meter as his companion, he thinks and talks in foot-candles just as the butcher talks in pounds. The foot-candle meter gives the lighting man a new prestige. It is the clinical thermometer that dignifies his profession above that of the vendor of a patented product.

Formerly, the man selling illumination talked earnestly with the manager about the lighting in his shop or factory but was forced to confine himself to generalities and consequently often found it difficult to effect changes which would have been a real service to his customer. With the foot-candle meter, this difficulty is largely overcome.

Most men like to be "shown," and the factory manager is no exception. Experience proves that many executives take pride in lighting systems which are very much at fault. The fault may be in the lack of proper diffusion of light or in the location of the light sources, or in the amount of light supplied. The foot-candle meter will not bring all the faults of a lighting system to surface, nor will it always tell what medicine is required, but, as the hydrometer indicates the exact condition of the storage battery, so the foot-candle meter indicates the condition of the lighting. The cure must often rest with the lighting specialist. The assistance of such specialists is readily available as a part



Finding out how much light reaches his desk.

of the lighting service supplied by all progressive lamp and reflector manufacturers.

Besides assisting in the movement for better illumination, this little instrument has been found extremely useful in the proper maintenance of lighting installations. In one large establishment where the superintendent uses a foot-candle meter systematically as a check on his maintenance department, readings of illumination intensity are taken at regular intervals at fixed stations throughout the plant. These readings are recorded in such a way that the successive readings are readily comparable, and when any inconsistency appears in the records an investigation is made and the proper remedy applied. Tests have shown that the value of lighting does not lie entirely in the first four foot-candles, nor in the first ten foot-candles, but that all foot-candles above these values contribute to the increased production of the plant. The importance, then, of getting all the foot-candles which the system is capable of providing, and which are being paid for whether they are lost in dust and dirt or not, is evident. Not infrequently, only one-half or even one-third of the light paid for is delivered; the use of the foot-candle meter avoids heavy losses of this character.

Practical Application of General Lighting Safety Orders

BY R. L. ELTRINGHAM

(A further explanation of the application of the General Lighting Safety Orders of California is here given by the Electrical Engineer of the Industrial Accident Commission which body has the enforcement of the Orders under its authority.—The Editor.)

The General Lighting Safety Orders issued by the Industrial Accident Commission, which became effective December 1, 1919, were drafted to create a reasonable minimum standard for illumination in all places of employment in the state of California for the primary purpose of protecting the sight and general health of employees. A casual study of the advantages of good lighting will reveal many interesting facts bordering upon economy and efficiency.

It is with the hope of making clear the application of these Orders that this brief article is written. It should first of all be thoroughly understood in taking up and discussing those cases which come up in every day practice that the intention of these Orders is to require a minimum distribution of light, whether accomplished by natural or artificial means, or a combination of both during the period of the day that the premises are occupied.

Lighting Industrial Buildings —

In the design of industrial buildings provision for ample distribution of natural light is indeed an important factor, as no source of artificial light can compare with that of the sun, although a greater intensity for day lighting is required than for night lighting. While the mandatory foot-candle intensities for various conditions and classes of work appear under Order 1503, it is strongly urged that in the design of a lighting system, the intensities recommended for different industrial processes appearing

in the appendix, more particularly from pages eleven to twenty-two inclusive, be given careful consideration.

The requirement for shading lamps for overhead lighting as set forth in Order 1505 may appear to many as somewhat technical, and for that reason create a doubt as to what should be accomplished. The diagram on page seven of Order 1505 indicating a definite relation between elevation above eye level and horizontal distance from the light source, simply establishes what is commonly termed "line of vision."

The intrinsic brilliancy or the intensity of light per unit area of the luminous source in the case of a bare Mazda C lamp is not only harmful to the eye, if placed in the line of vision, but indeed ruinous to sight. This is also true in no small way of Mazda B lamps, similarly located.

The Line of Vision —

Just what do we mean by "line of vision"?

Perhaps the simple way to explain it would be to say that an unshaded lamp so placed that the direct ray from the luminous source will strike a person directly in the eyes from any location assumed by him during the ordinary performance of his work is in the line of vision and should be shaded. The shading of lamps for local lighting is also important and should be given attention in each particular case for the same general reason as mentioned above. It may be said that, with few exceptions, the types of lamps

used today to produce efficient lighting will come under this shading requirement.

Emergency Lighting —

The section of the Lighting Orders about which there seems to be considerable doubt under the sub-heading of Emergency Lighting is Order Number 1508. It is hoped that the small type notes, number one and number two, under Paragraph A of Order 1508 will serve to make clear the intent. The required intensity for emergency lighting is one-quarter foot-candle, this intensity to be distributed to all workspace aisles, stairways, passageways, exits, outside landings of fire escapes, etc.

It might be well to set out more clearly what is meant by workspace aisles, it being assumed that other specially mentioned locations need no further definition. In the case of assembling plants, erecting shops, foundries, machine shops and other industrial spaces where it is impractical definitely to lay out passageways leading to the outside, emergency lighting should be distributed over the entire area under the caption of workspace aisles.

Quite frequently questions are asked concerning emergency lighting in storehouses and general storage spaces, plans for which are submitted for approval which are decidedly sketchy in character. In many such instances it is intended to build long tiers of shelving carried from floor to ceiling for the storage of miscellaneous merchandise. In cases of this kind, the regular lighting and emergency lighting systems should be located in the definite passageways formed by such shelving. Where the shelving is not carried to the ceiling and material would not interfere with light distribution, the emergency circuits could well be placed on the ceiling.

A great deal of misunderstanding and doubt would be cleared away if those concerned with this question generally would have what is desired to be accomplished definitely fixed in their minds and make calculations accordingly. The emergency lighting should be considered a part of the general illumination and, hence, should be used concurrently with the regular lighting, doing away with the necessity of turning on the emergency upon failure of the regular system, thereby experiencing no interruption.

Emergency Lighting of Public Buildings —

Paragraph A of Order 1508 requires a separate source of power supply independent of the regular lighting system in theaters, public meeting halls, moving picture exhibition places, hospitals, etc., to supply the emergency lighting system.

In the case of theaters, public meeting halls, moving picture exhibition places, hospitals, schools, etc., it will be necessary that the emergency lighting circuit be equipped with an automatic throw-over switch that, on account of failure of the regular source from which the emergency lighting system is normally to be supplied, the automatic switch would, without manual intervention, transfer the emergency lighting circuit to the auxiliary source of supply.

In many instances, owing to a single power company in the locality, a storage battery will have to be resorted to. The question of failure of the storage battery when needed, due to lack of maintenance, has been raised. To offset this contention adequate battery service can now be furnished in the smaller communities by those engaged in the battery-service business and frequently the direct representative of the battery manufacturer.

The emergency lighting system should be installed and controlled so as to present the least possibility of interruption by having fuse cabinets backed and flush switches of the key type. In Order 1509 reference is made to pilot or night lighting which may be a part of the emergency system. The object of pilot or night lighting is to afford sufficient light for the night watchman safely to make his rounds without the need of a lantern or flashlight.

The Location of Switches —

The switches controlling night lights should be so located in relation to the entrance that the watchman or any other person may enter the building at night and light his way ahead. Take for example a store with stairway and elevator in the rear leading to the basement and upper floor. A switch should be located at the entrance to turn on sufficient light to enable a person to find his way to the stair landing or elevator in the rear, and another switch at the stair landing to light his way either up or down, enabling him further to light up the basement or upper floors and turn off all the lights as he leaves the building. All emergency light-circuit switches should be plainly identified by stencil or plate on fuse cabinets and placing switches on conspicuous targets or otherwise by distinctive marking. Emergency light circuits should be protected by fuses in the same manner and kept separate and distinct from the regular lighting system.

Suggestions which may prove helpful in laying out lighting systems are contained in the appendix to the Orders which is advisory in character and not in any way mandatory.

ELECTRIFICATION OF THE STOCKHOLM-GÖTEBORG LINE

The Second Chamber of the Riksdag recently adopted the resolution previously acted upon favorably by the First Chamber, appropriating 23,000,000 crowns (\$6,164,000) for the electrification of the railroad line Stockholm-Göteborg, the amount to be expended during the year 1921.

The action of the Riksdag may be taken as a sure indication of the purpose of the Government to bring about the electrification of the entire system of the state railroad in Sweden. The bill now only awaits the Royal approval, which will no doubt be given.

There ought to be good opportunity for American electric companies to present bids for the work, and it has been suggested in a commerce report that they write to "Kungliga Järnvägsstyrelsen," Stockholm, Sweden, for particulars.



A group of tropical shrubbery which usually was a dark blot at night, was transformed into a mass of fairylight tracery by electrical illumination, every frond and twig thrown into relief by carefully concealed lights.

Garden Illumination

(Not only use but beauty is among the functions of electricity, and illumination as a form of decoration, indoors and out-of-doors, is becoming every day more popular. Following is an account of the garden illumination which delighted the guests at the N. E. L. A. Convention at Pasadena.—The Editor.)

The illumination of the grounds of the Hotel Huntington during the recent N. E. L. A. convention at Pasadena was a fine example of the exquisite effects which can be secured with this form of decoration.

In the Japanese gardens of the hotel are four small ponds located on different terraces and connected by streams running the length of the garden. These are surrounded by many varieties of Japanese ferns, palms, dwarf oaks and bamboo trees against a background of large oaks and eucalyptus. Six 500-watt floodlights mounted at heights of from 25 to 35 feet, each equipped with 400-watt Mazda C Sunbeam lamps, covered the main section of the gardens and also illuminated the tall eucalyptus trees.

On the left side were located eight 500-watt Western Electric floodlights, each equipped with 400-watt Mazda C Sunbeam lamps which were focused across the garden and illuminated the shrubbery on the right hand side of the canyon, and also covered the lawn and pools with wide angle rays from the same units. On the right-hand side were located six 500-watt Western Electric Davis floodlights each equipped with 400-watt Mazda C Sunbeam lamps used at wide angle flood settings to cover the center and left-hand side of the garden. These lamps were located at an angle that removed any glare from the hotel buildings, thereby allowing guests the opportunity of viewing the grounds with-

out looking directly into the light from any of the lamps used.

In the center of the hotel building, and approximately one-quarter of an acre in extent, is a garden with a large bed of flowers and date palms, bordered by tropical plants, palms and large trees. The center section and palms were illuminated by four Western Electric Utility units each equipped with 200-watt Mazda C Sunbeam lamps. The oak and large palms in the border were illuminated by two 500-watt Mazda C Sunbeam lamps. The low border plants were illuminated by the use of Benjamin elliptical angle reflectors set in the ground.

The main tropical gardens are located at the northeast side of the buildings and cover approximately two and one-half acres. They consist of tropical flowers, ferns, palms and small plants, the banana palms in the center being 30 feet high.

The borders are of ferns, palms and shrubs, and the border running around the main garden consists of fern trees, tropical flowers of delicate coloring and texture, fuchsias and cyclamen of varying types and colors. This whole group was illuminated with a combination of utility units, floodlights and reflectors, every detail in the graceful feathery foliage being admirably brought out.

Directly in front of the hotel entrance are located two large fir trees and large clumps of bamboo. These were illuminated from the roof of the

hotel building by the use of three 500-watt Western Electric Davis floodlights and one 1000-watt Western

Electric Davis floodlight was used to bring out the detail of tree-tops.

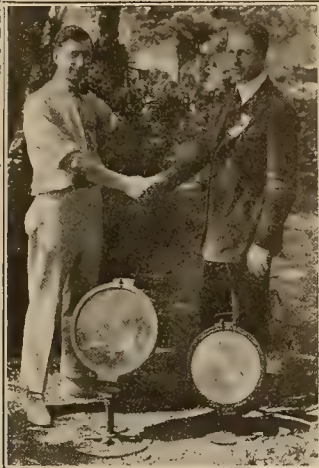
All the gardens were illuminated from the ground, thereby bringing out the delicate tracery of the foliage and flowers, giving the greatest effect in the color scheme.

The contrast between the daylight photographs and the same scenes taken at night showed the wonderful possibilities of the floodlight when used in the proper manner, as all of these units were located at angles which threw the light directly on the shrubbery

and plants and still eliminated any unpleasant glare while looking at the gardens. The units were practically hidden by the plants and ferns.

The total number of units used was 93 and the total consumption of power equaled 30 kw.

The entire lighting effect was laid out and installed under the personal supervision of A. G. Humphreys, Electrical Engineer of the Plant Department of the Southwestern Shipbuilding Company, East San Pedro, California, and Mr. J. G. Loomer, of the Western Electric Company, Los Angeles, Floodlight Expert.



A. G. Humphreys and J. G. Loomer, to whom goes the credit for the design and installation of the lighting effects described in the accompanying article.

SELLING MAZDA LAMPS

BY CLARENCE LLEWELLYN

(This story of the Los Angeles Electric Appliance Shop contains many valuable suggestions concerning the sale of lamps, shop location, and general selling policy.—The Editor.)

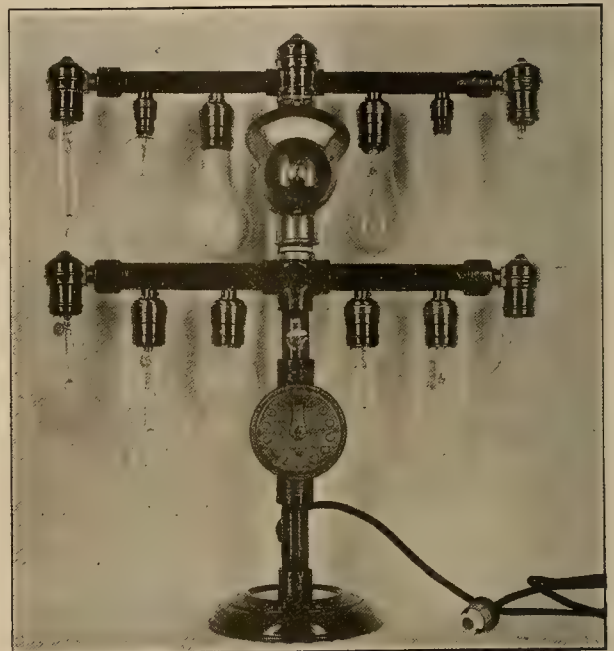
Doing more than a one hundred-dollar retail business on Mazda lamps over your counter without sub-contracts or without doing wiring contracting, is considered a pretty good business. After having used several kinds of display racks, we have designed one which has been responsible for a great part of our increased sales. This device makes it possible to show the customer how much current the globes use, and if the clerk is busy with others, the customer can decide himself upon the type of globe he wants.

It has always been the custom of our shop to have extra globes on hand when stock is short. In order to make this possible, I built a frosting machine three years ago. If every lamp agent would put in his own frosting machinery, his stock could be from one-half to two-thirds less than what he now carries. Furthermore, I believe that the lamp manufacturers will welcome this idea, because their supply is so limited that they are now employing extra help in order to check over agents' stock so that dead stock may be removed and every agent

may have his full quota. We have found it necessary to do special work such as making bull's eyes, half frosting and bowl frosting for our customers.

Making a Record —

When I started in business, three and one-half years ago, I had just twenty dollars. Today I have what I consider the prettiest shop in the heart of Los Angeles. My rent is half of a \$533 per month store room. The other half of this store is a typewriter shop. The two lines go well together. My success here leads me to advise men going into the appliance and Mazda lamp business to locate in the heavy traffic or shopping districts of their city. Our appliance and lamp sales, not including such stock as washing machines and vacuum cleaners, will run about six hundred dollars this year. I always plan



By pressing the correct button, the current consumption of any one of the dozen lamps is registered on the attached ammeter. This is a simple and effective way of helping the customer decide upon the lamp best suited for his purpose.

to be in the front of the shop so I can get acquainted with customers when they enter the store.

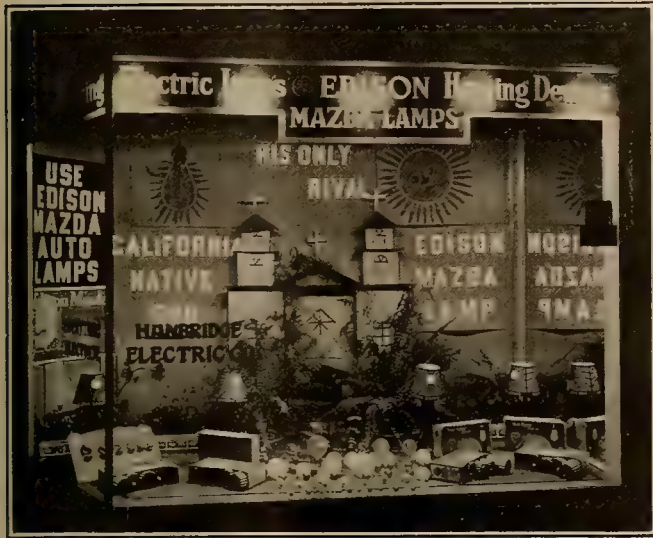
There are but a few standard makes on the market and for this reason the use of so many name plates is really undesirable. They mean nothing and in time make for more trouble and the necessity of carrying a larger stock. Many dealers think they have to carry the sample of an appliance that they don't sell in order to knock it. This does not bring profit and is of course unfair.

Method of Selling —

I like to pick what I think is best and offer that to the customer, allowing him to make his own final decision. Often in selling what I think is best, I am considered a nut by the customer, because many have no idea of what is inside the appliance. If two customers entered your shop at the same time and one wanted to see an appliance and the other wanted a lamp, what would you do? We give the first attention to the latter, for in so doing we feel we are working best to establish permanent trade.

The Dealer's Window By Night

(The electrical store has come to be the brightest spot in its neighborhood after dark, the attraction which draws window shoppers from their aimless wanderings to the inspection of its bright nickel and attractive appliances. The photographs given below of Western stores which are taking advantage of evening as well as daylight hours to carry their message of good merchandising are instances of what is possible in setting an example of good window illumination which may be followed by other merchants of the neighborhood.—The Editor.)



The best time to advertise the mazda lamp is at night, a fact which was realized by the Hanbridge Electric Company of San Francisco and which resulted in this effective window. The mission here shown is made from the lamp cartons painted an adobe color, set in a background of grass sod and ferns.



The colorful windows of the Sullivan Electric Company of Modesto, California, are most attractive after they have been illuminated for the evening. The tasteful and natural arrangement of furniture and appliances appears to good effect in the light of fixtures similar to those which would be used in the home in similar surroundings.

Fixtures were meant to be displayed at night time and nothing is more attractive than a well arranged grouping of lamps and wall brackets. The low curtain which forms the background for the windows of the Valley Electrical Supply Company of Fresno places the entire store in the window.



In the daytime the interior of the store is darker than the street and must compete with many other attractions, but at night it may be made to stand out so that the passerby feels that he is standing in the midst of the stock which is so brightly illuminated. The customer picks out what he will buy tomorrow.



An example of the effective lighting of a window with a scattered display. The concentrating of the light has the same effect in unifying the group that the mammoth battery with its background of drapery has in the daytime. Every window, as every picture, should have a "center of interest."



One of the features of the N. E. L. A. convention at Pasadena was the windows of the electrical stores in town, which were especially featured for the occasion. None attracted more attention than that of the H. L. Miller Company, which combined beauty of design with motion and color.

Electric Sign Manufacture

BY R. E. SMITH

(Western manufacturers have invaded nearly every line of industry followed anywhere in the country. The following article describes the processes and plant of the Electrical Products Co. of Los Angeles, who make a large part of the electric signs sold in Southern California.—The Editor.)

It does not seem easy to standardize such a business as sign manufacture where one of the principal sales points is individuality and each article is produced from a special design. But this is exactly what has been done in Los Angeles by the Electrical Products Corporation which has so organized its shop procedure and methods that the work moves from one department, and from one bench, to another in much the same way that automobiles move through the most modern factory which produces the large number of machines commonly met with.

The general outline of the process, for it is a process and not a job-order system, is as follows: When an order starts through the shop the first step

which the woodworking department has made in the interim.

The plant maintains a continuous schedule for production, turning out on the average nine complete signs daily. The time taken during the regular production program is such that about one hundred signs are in the shop at any one time, and a working force of forty to fifty men is employed.

As an example of what other manufacturing plants on the Pacific Coast may expect in the way of growth, the evolution of this company is of interest. Starting in 1912 with a ground space of 1600 square feet, the business has expanded to fill a building having over 17,000 square feet of floor area. From a

purely local market the firm now sells in China, Japan, Hawaii, Manila and the west coast countries of Central and South America. This latter business is all through mail orders although generally the foreign orders are consummated through export firms who handle the financial end.

Some years ago the company entered the field of making and operating interchangeable signs for theatres and has found this to be a very profitable business. Another somewhat similar field has been the

manufacture of complete theatre electrical lighting apparatus such as footlights' strips and borders. They also design and install interior decorative lighting installations.



The home of the Electrical Products Corporation of Los Angeles. These producers of electrical signs have been especially successful in organizing their work along the lines of modern large scale production.

is the cutting of the tin faces of the letters. This is done in the tinsmith's department which follows standardized forms unless the order calls for special shapes of letters. In this one step there is a great saving in time and material as the workers become familiar with the usual shapes and lose no time in executing the design. After the faces are cut the galvanized channel iron sections for the ends and sides are assembled. The sections are purchased in quantities of the sizes usually required and a further saving is effected by reducing hand work at this point.

The other steps follow in rapid succession. The receptacle strips—also on hand in standard lengths—are added by one man and the sign moves on to the wireman. This step is practically uniform for all signs, consisting of the addition of the receptacles themselves and the wires connecting them. Following this the luminous facings for the letters are added and the sign is ready for the paint shop where the specified colors are put on. Meanwhile the blacksmith department has made the hanging rig or fabricated the support, if the sign is a large one, and the sign is complete for placing in the shipping crate

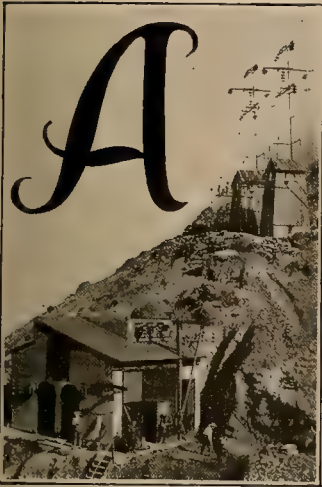
PAMPHLETS AND CLIPPINGS IN THE BUSINESS LIBRARY

The Journal of Electricity has the pleasure of announcing that it has secured for the benefit of its readers a short series of articles on this timely subject. Business offices today are flooded with pamphlets, leaflets, newspaper and magazine clippings, and the difficulty that confronts business offices is how to handle effectively this flood of valuable print. The Journal of Electricity has arranged to publish a series of five articles entitled "Pamphlets and Clippings in a Business Library" that will discuss their value as sources of up-to-date information, where the best pamphlets on any given subject can be obtained and the best method of filing them for ready reference. The series of articles will be written by Miss Virginia Fairfax, Librarian, Carnation Milk Products Co., Chicago, formerly of the Publicity Department of Robert W. Hunt & Company, Engineers, Chicago.

Electric Power for Mining

BY F. S. VIELE

(The dependence of Western development upon electricity is nowhere more marked than in agriculture and mining. An interesting account of developments supplying the latter industry is given in the following article by the president of the Arizona Power Company.—The Editor.)



Jerome substation of the Arizona Power Company, 3000-kw. capacity, serving mines and smelters in the Jerome district.

BOUT the first question asked by strangers contemplating mining operations in any district is, "Can we get power for such operations?" In a country where water is particularly scarce, and when available is often injurious to boilers, and where haulage problems are great and offer serious obstacles to the easy securing of fuel, the question of power, and particularly cheap power, becomes of paramount importance in any industrial development.

The present power situation in Yavapai county, Arizona, has been most satisfactorily solved by the Arizona Power Company, who furnish electric power from two hydroelectric plants aggregating 12,000 hp. and a modern steam plant of 10,000 hp. capacity.

The northern part of the county, in which are located the great producing mines which make the district so justly famous, is covered by extensive transmission lines over two hundred and fifty miles in length, by means of which electric power is delivered at the very door of every mine or prospect in the district.

That the cost of power from this source is satisfactory, at least to the users, is evidenced by the fact that every producing mine, and practically every prospecting company is using electricity furnished by the company.

In March, 1918, the customers served and the approximate demands of such customers was as shown below:

Customers	Hp. Used
A. T. & S. F. Railway.....	100
Prescott City Pumping Plant, Del Rio.....	100
Consolidated Arizona Smelting Company—	
Humboldt Smelter and Mill, Blue Bell Mine,	
De Soto Mine	1500
United Verde Copper Co., Jerome and Clarkdale.....	5000
United Verde Extension Copper Company.....	1500
Hayden Development Company.....	300
Prescott Gas & Electric Company.....	300
Big Pine Mining Company.....	300
Bradshaw Reduction Company, Crown King.....	300
Arizona Binghamton Copper Company.....	450
Copper Queen Mining Company.....	100
Big Ledge Development Company.....	350
Jerome Verde Mining Company.....	350
Pittsburgh Jerome Mining Company.....	100
Arkansas & Arizona Copper Company.....	100
Jerome-Portland Copper Company.....	75
West United Verde Copper Company.....	200
Gadsden Copper Company.....	300
Green Monster Mining Company.....	250
Jerome Del Monte	150
Locey Pabst Gold Mining Company.....	100
Verde Combination Copper Company.....	250
Dundee-Arizona Company	200
Shannon Copper Company	200
Cottonwood Township	100
Mayer Township	50
Total.....	12,825

The Arizona Power Company, incorporated under the laws of the state of Maine, was formed in 1908 to take over the interests of an Arizona corporation which had appropriated the waters of Fossil Creek.

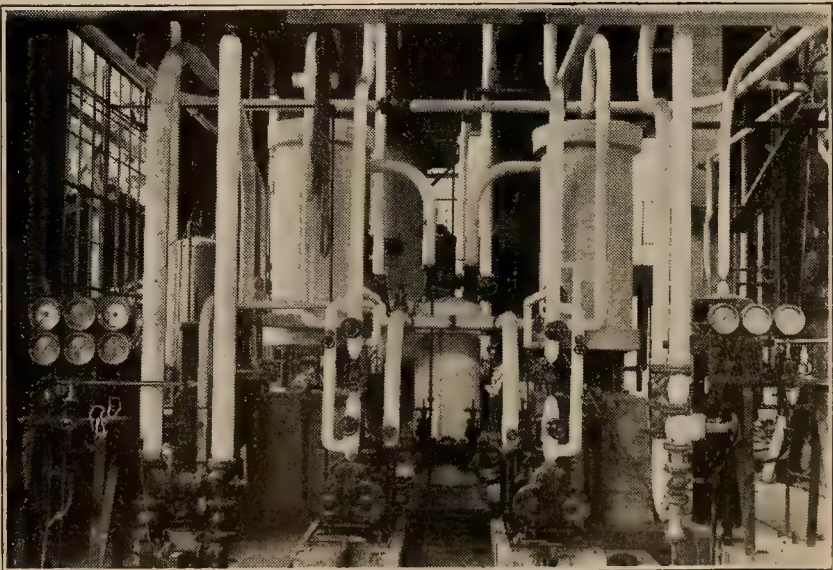
Water Source

Fossil Creek derives its name from the fact that the water covers sticks, stones and any foreign substance, with a formation which makes them look like fossils. The water evidently comes from a great depth, and gushes out abruptly from a rock cliff at a temperature of 72° Fahrenheit, with a constant flow of 43 cubic feet per second, absolutely the same in volume winter or summer, dry season or wet; that the quantity from the springs never changes has been proved by practically daily measurements since 1902.

From its source at the springs, located at the junction of Conconino, Gila and Yavapai county, Fossil Creek runs in a generally southeasterly direction a distance of about fourteen miles, where it empties into the Verde River. From the springs to the river the creek has a total fall of 1600 feet, and this fall is utilized in two hydroelectric developments, the upper plant using 500 feet and the lower 1080 feet.

About two hundred yards below the lower spring, a concrete dam is built across the creek bed, diverting the entire stream flow to a concrete intake tunnel, provided with suitable gates to keep out rubbish, logs, and so forth. From this tunnel the water enters a semi-circular steel flume, 5 ft. in diameter, carried on wooden trestles and supported on concrete footings.

The flume is laid on an hydraulic gradient of 1 foot to the 1000, the wooden trestle varying from five feet in height to sixty feet where bridges span



Pump system automatically supplying oil and steam for entire Tapco steam plant of the Arizona Power Company

the numerous small canyons. The length of flume from intake to the head of the pressure pipe is 22,000 feet, with an inverted siphon 480 feet in length, and having a drop of 146 feet, about in the middle of the flume. At the end of the flume a concrete box fitted with gates, cleaning racks and electrical devices to indicate to the power house operator the height of water in the flume, is connected directly to a steel pressure pipe 3300 feet in length which carries the water to a Francis turbine located at the creek level 500 feet below.

The pressure pipe is in the greater part of its course buried in the ground, and where exposed is supported on concrete piers. The turbine of 2500 horsepower capacity is directly connected to a General Electric 2300-volt generator of 15000-kw. capacity. The 3-phase, 60-cycle current as generated is raised by a bank of three transformers to 45,000 volts and transmitted to the main generating station on the Verde River eight miles away.

Storage System

The tail race of the upper or Irving plant empties directly into the intake of the larger plant, which is located at Childs on the Verde River. The intake is concrete and forms a pool 40 by 20 feet and 15 feet in depth. From this intake the water is carried on a grade of one foot per thousand to an artificial reservoir, Stehr Lake, having an area of 28 acres.

Stehr Lake forms a storage reservoir of sufficient size to carry the rated load of the Childs station unassisted for a period of 24 hours. The lake was formed in a natural depression of the hills by earthwork dams at either end. At the lower end of the lake, seventeen feet below the normal level of the water, is located the portal of a pressure tunnel which pierces the mountain 5200 feet, to the valley of the Verde River on which the power house is located. From the western end of this tunnel a reinforced concrete pipe four feet in diameter skirts the edge of the mountain a distance of 1400 feet to a concrete surge tank 30 feet in diameter and 36 feet high. The concrete pipe is under a constant hydraulic head of 30 feet.

From the bottom of the surge tank the water is carried in a steel pressure pipe 4800 feet long to the turbines in the power house 1080 feet below. The pressure pipe is 48 in. in diameter at the surge tank, 36 in. diameter at the power house, and for the lower half of the distance is of welded steel $\frac{3}{4}$ -in. thick at the bottom. From this entire water conduit there has never been one minute's trouble in the nine years of operation.

Power House Equipment

The power house, located on the east bank of the Verde River, is of solid concrete construction with adjoining transformer house above and similarly built. Each of the three turbines in the power house has a rated capacity of 3000 hp. and each is directly connected to an 1800-kw. generator supplying current at 2300 volts, 3-phase, 60 cycles. Each generator is connected to a bank of three transformers which raise the voltage to 45,000 volts, for transmission.

The turbines are controlled by oil governors, and a special Tirrel regulator is provided to operate the exciters of each generator when they are working on the same transmission system.

Transmission

The transmission line passes from the east side of the river across the river and up the rim of the western mountain, a climb of 3500 feet over the most rugged country. In nearly an air line it is then carried to a switching station at Joland Junction on the Santa Fe, Prescott and Phoenix Railroad, a distance of 35 miles.

Considerable trouble was experienced from lightning on the line over the Verde River, at the commencement of operations, and a supplementary line on wooden towers was constructed up the Verde val-



Concrete pipe, connecting pressure tunnel to pressure pipe at plant head, under about 17 ft. head

ley 51 miles to Clarkdale, the site of the United Verde Copper Company's new smelter, and thence to the Jerome sub-station. Each property is therefore able to secure power from two directions.

From sub-stations at Jerome and Clarkdale all of the various mines and prospects in the Jerome district are reached by taps from the main line or by 2300-volt distributing circuits.

In March, 1918, the transmission lines owned and operated were as follows:

Main Tower Lines	45,000 volts,	180 miles
Distributing Line	17,000 volts,	27 miles
Distributing Line	11,000 volts,	34 miles
Distributing Line	2,300 volts,	20 miles

Total of three-wire lines, 261 miles

or over 800 miles of copper transmission wire and steel groundwire.

It is an interesting fact that practically all of the copper wire was purchased from the United Verde Company's wire drawing plant at Perth Amboy, N. J., and it has therefore traveled east as bullion, back again as wire, and now serves to carry current to operate the mines from which it was originally taken.

In order to construct the two hydroelectric stations, it was necessary to build eighty miles of wagon

road from the railroad due east to the Verde River and thence to the springs. Sixty miles of this distance there was not even a trail before the work commenced. This road reached an elevation of 6,600 feet, and from the rim of the Verde River to the location of the power house at Childs, there is a drop of 3,500 feet in a distance of eight miles by the road. Over this mountain road by means of auto trucks, mule teams and burros over 60,000,000 pounds of freight has been transported.

Auxiliary Steam Plant

In the summer of 1916 the demands for power increased so rapidly, due to the wonderful development of the United Verde Extension Mining Company and the consequent impetus given to development operations in Yavapai county, that the water power plants of the power company were badly overloaded. In order to provide reserve capacity and take care of the present requirements, a subsidiary company, The Arizona Steam Generating Company, was formed to build a modern steam generating plant, which was located at Tapco on the Verde River, three miles north of Clarkdale. Construction of this plant was commenced in February, 1917, and the plant was placed in operation September 1, 1917.

The power house is located about half a mile from the tracks of the S. F., P. & P. Railroad, and is directly connected with the railroad by a standard gauge spur track 2800 feet long. The building itself is constructed of concrete throughout, with the exception of the western end, which has a corrugated iron finish, so that the future additions can be made with a minimum of expense. The boiler room is 110 ft. long, 75 ft. wide and 35 ft. high, and the turbine room adjoining it 66 ft. long, 40 ft. wide and 42 ft. high. The equipment is of the most modern construction and is designed to give the maximum of efficiency.

Fuel Supply

Oil fuel is used under the boilers, and immediately west of the present boiler room there is an oil unloading station on the spur track consisting of a concrete trough with four openings so that four carloads of oil can be emptied at one time. From this unloading tank the oil is pumped by electrical power to two auxiliary tanks back of the boiler house, which contain 24 hours' supply of oil, or to a large storage tank located about 1000 feet from the boiler house. This storage tank contains 30 carloads of oil, enough for one month's operations. The boilers are also arranged to use coal in case the change is desirable.

The water for the boilers is obtained from a well in the basement, and before being placed in the boilers the water is thoroughly purified of all foreign matter in a carefully designed laboratory located in one corner of the boiler room. From this laboratory the water is pumped to a feed water heater and from the feed water heater is forced by duplicate sets of pumps through the economizers and thence into the boilers themselves. The oil feed pumps, which are in duplicate, are located immediately in front of the water pumps and supply oil directly to the burners

under the boilers. The amount of oil and steam for vaporizing is automatically regulated by the demands upon the boilers themselves.

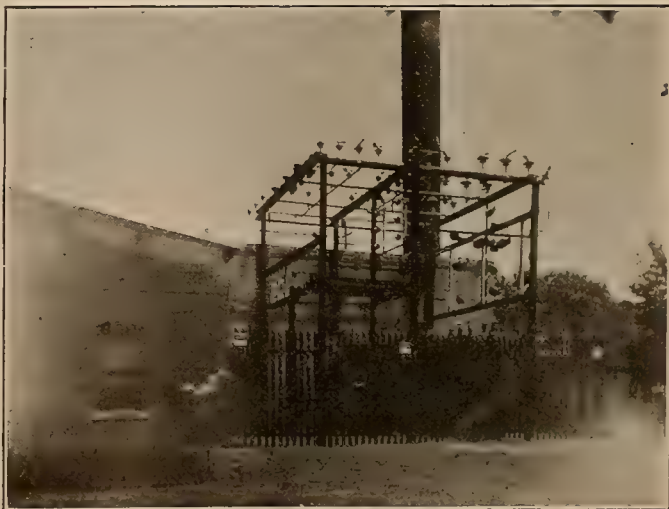
The generator, which is of 10,000-hp. capacity, has a specially constructed air cooling device which forces cool air through the windings of the generator and thence into the open air. The water circulating system for cooling bearings is operated from a large tank on the roof of the engine house, whence it flows by gravity through the bearings of the turbine and generator and thence through cooling coils immersed in the conduit which carries the condensing water to the condenser. From this point it passes to a large storage tank in the basement from which it is pumped to the tank on the roof by electrically operated centrifugal pumps.

The presence of this steam plant as an auxiliary reserve was deemed advisable by the directors of the Arizona Power Company to take care of the rapidly increasing demands of the Jerome district, and also to act as a guarantee against interruptions on the long transmission lines from the hydroelectric plant. The double transmission lines from the steam plant to Clarkdale are one mile in length. From the Clarkdale substation a new line is being built to the Hopewell Crushing Plant of the United Verde, and thence to the present Jerome substation. The liability to interruptions on the electrical circuits will be reduced to a minimum by the addition of this much-needed reserve and the company is prepared to add to the size of the steam plant as the demand of the customers requires.

In 1919 an extension 77 miles long of the transmission line was made to Phoenix and pumping power is now provided in the Salt River valley from the plants of the Arizona Power Company.

On an official test at full load conducted for three days, in November, 1917, the steam plant developed 335 kw-hr. per barrel of California crude oil, a result which is not surpassed by any similar size plant in the world.

A TIE-IN OUTDOOR SUBSTATION



Delta-Star Unit Type 3300/13200 kva., three-phase outdoor substation recently erected by the Canton Gas & Electric Company of Illinois. This station steps the voltage to 13290 volts for the line which goes to Lewiston and for tying into the 13200-volt line running to Canton.

Convention of California Contractor-Dealers

(Nearly two hundred members of the electrical industry gathered at San Jose for the annual meeting of the California State Association of Electrical Contractors and Dealers. A number of excellent papers were presented there and the spirit of the convention was one of cooperation with the other branches of the industry and the uplifting of the contractor-dealer branch to assure the public of better service. The California Association has done good constructive work in the past year and with the progressive program laid out for the coming year it will do much toward bettering the industry as a whole.—The Editor.)



Clyde Chamblin was re-elected president and is right now daring anyone to violate the code of ethics.



Cap Angus, California Cooperative Campaign, advertising the fact that advertising pays.



Clark Baker, National Lamp Co., Oakland, is probably thinking of a certain gentleman from Los Angeles.



We don't know what Glenn Arbogast was thinking about but he didn't do it that afternoon, anyway.

The keynote speech of the annual convention of the California State Association of Electrical Contractors and Dealers was made by Albert H. Elliot, counsel for the Association, at the banquet on the evening of June twenty-sixth. Speaking on "The Value of the Association" Mr. Elliot brought out the ideas that had been expressed throughout the entire convention in the papers presented, the discussion on them, and the action taken to insure the upbuilding of the industry and better service to the public. The convention was a complete success from every point of view and the intense interest shown by the delegates in all of the proceedings proved the desire of all to cooperate to the fullest extent with all branches of the industry to make this a banner year for the electrical trades.

The business session of the convention was opened by a discussion of Garnett Young's paper, "Cooperation With Architects and Builders," by Clyde L. Chamblin, San Francisco, president of the state association.

In discussing this paper Mr. Chamblin stated that the California Cooperative Campaign had carried out all of the plans outlined by Mr. Young with great success and mentioned the good work being done by Mr. Price. Mr. Chamblin then quoted the figures prepared by the Society for Electrical Development which had appeared in the "Live Wire," the official announcer of the San Francisco Electrical Development League, to show the enormous business that is waiting for the electrical contractor and dealer if the architect and builder will cooperate with him.

That this cooperation be extended to include stores and industrial plants, was the suggestion of C. B. Kenney, San Francisco. Mr. Kenney pointed out that unless the plans and wiring diagram of a building were complete there could be no fair competition as each contractor would interpret the diagrams differently, and that in case of doubt he must necessarily add enough to the job to insure him making a fair profit. He suggested that a competent illuminating engineer lay out the plans for any large industrial installation and added that this would entail but little extra expense to the job and would insure a satisfied customer.

E. E. Brown, San Francisco, suggested that a committee from the contractor-dealers' association meet with the electrical and mechanical engineers to formulate a scheme whereby the wiring plans of all buildings would be added to the architect's drawings by a competent engineer. This committee could then meet with the architects and discuss this scheme, and Mr. Brown stated that this was a possible solution of the problem.

The practice of bidding low to get a job and then adding a lot of extras at an excessive profit to break even on the entire job was condemned by J. C. Hobrecht, Sacramento, who suggested more attention to detail in making up a bid and if extras were found necessary to add them at only a fair profit.

Mr. Romaine Myers, consulting engineer Oakland, then stated that in all of the cases that he had seen, there was only a difference of five per cent between the high and low bidder where the wiring diagrams had been properly laid out. In cases like this it is more satisfactory to all concerned, as the contractor knows how to bid and the owner knows what he is going to get and there are no extras.

The necessity of warning consumers against using all appliances on a lamp socket was suggested by Max Loewenthal of San Francisco, who stated that all appliances over 660 watts should have a special outlet.

The discussion on this paper was closed by Mr. T. M. Robinson, Robinson Electric Company, Fresno, who told of the city ordinances in that place relative to the wiring of stores and homes.

ADVERTISING

Captain Howard M. Angus, secretary of the California Electrical Cooperative Campaign, then read a paper on "Advertising" which he had prepared for the convention and which completely covered the field of advertising in which those present would be interested. This is one of the most complete papers ever presented on the problems that are peculiar to the advertising and merchandising of electrical goods.

Mr. Louis Levy, Levy Electric Company, San Francisco, recommended the more extensive use of bill boards and manufacturers' literature as a means of reaching the public, and stated that he believed that successful advertising was the result of repetition of the name of the firms to the public.

The necessity of advertising by the contractor was the message of M. T. Dolman, Pacific States Electric Company, San Francisco, who stated that by this means the architects and home builders could be educated to the idea of adequate wiring of homes and industrial plants.

"Service will hold consumers but more than that is necessary to get them," was the idea of G. E. Arbogast, Los Angeles, who said that while the older contractors were well known all over the state to the members of the industry, they were unknown to the public, and

for that reason, the contractors must advertise themselves.

Mr. Arbogast also spoke of the value of the convenience outlet campaign of the California Cooperative Campaign to the contractor and stated that the contractors should follow this up by intensive advertising. The industrial lighting exhibits that are to be installed by the Cooperative Campaign were explained and the contractor urged to use these to help him convert managers of industrial plants to better lighting.

Talks and lectures on the value of electricity for home use to be given to women's clubs and high school classes, were suggested by Max Lowenthal, as a means of getting close contact with the public and especially the coming generation of consumers.

VALUE OF APPLIANCE SOLICITORS

The discussion on the paper by A. W. Childs on "The Value of Appliance Solicitors" was started by G. E. Arbogast, who read excerpts from the original paper to establish certain facts and then gave figures based on his own experience.

He stated that the store was opened in 1914 and by 1918 the business had been built up so that \$49,800 worth of goods had been sold over the counter. In 1919 the sales averaged the same as in 1918, or about \$3500 per month until August. At this time the firm started an extensive advertising campaign and sent out solicitors, with the result that the sales averaged over \$15,000 per month for the rest of the year. In the first five months of 1920 the firm had done a business that amounted to \$67,833.60, and that they figured on a \$200,000 business this year. This great increase in sales, Mr. Arbogast stated, was due to a large extent to the solicitors that had been sent out and who had covered the territory thoroughly not once but many times.

The fact that the majority of the dealers do not know how properly to finance themselves was brought out by Max Loewenthal, San Francisco, who dwelt at length on the dangers of allowing too many long-time-payment contracts to accumulate. The majority of people who buy the larger appliances do not need a long period of time in which to pay for them, and Mr. Loewenthal recommended that the customer be allowed six months to pay for the appliance except in special cases, and went on to say that this system of doing business would probably cause the dealer to lose a few customers but it would increase his financial standing because he would be doing business on a sound basis. The amount of money tied up in the larger appliances that are being sold on time payments, he stated, is a serious problem to the average dealer who has to borrow money from the banks to carry on his business while this money is outstanding.

A plea was made by G. E. Arbogast, Los Angeles, to keep the contracting and dealing business together and not try to run either as a separate business. In this way, he pointed out, a good live contracting business will furnish the capital to the merchandising side of the business which will enable it to carry notes on its larger appliances at a nominal rate of interest; consequently it will not be necessary to borrow money from the banks at the present rate of interest which is proving hard on some of the smaller dealers.

The idea that selling appliances on time was a banking proposition was brought out by

H. W. Kimball, Oakland, who stated that the customer paid interest on the note in his payments on the appliance. He said that there had been some talk of starting an electrical bank to be supported by the industry, which would make a business of loans on time-payment contracts and would probably be of assistance to all branches of the industry.

VALUE OF PROPER ILLUMINATION

Extracts from the paper prepared by F. D. Fagan, Edison Lamp Works, San Francisco, R. E. Fisher, Pacific Gas and Electric Co., San Francisco, and H. W. Kimball, Oakland, on "The Value of Proper Illumination" for the last convention of the Pacific Coast Section of the N. E. L. A. were read by Mr. Kimball.

Discussion on this paper was started by Clark Baker, National Lamp Works, Oakland, who gave the results of a survey of lighting conditions in industrial plants that was conducted by the lamp manufacturers. This investigation was made by four specially trained men and included 440 plants investigated in 57 different towns in fifteen different states so that the results would be typical of conditions in the entire country. It was found that the average proportion of work done under artificial light in industrial plants was twenty-five per cent, according to the estimates of the executives interviewed, but this figure is believed to be low. In a chart showing where the manufacturer would seek advice regarding lighting changes it was shown that:

25%	would ask the	electrical retailer
21%	"	electrical jobber
13%	"	consulting engineer
9%	"	central station
32%	miscellaneous	

The total figures proved that 72% would go to the electrical distributor or to some one in their own organization. This would seem to indicate that the electrical jobber and retailer are the factors dominating the situation. The advantages of proper lighting were pointed out by Mr. Baker by the following table which is an appraisal by the manufacturers visited:

Increase in production.....	79.4%
Decrease in spoilage	71.1%
Prevention of accidents	59.5%
Improvement of discipline	51.2%
Improvement of hygienic conditions.....	41.4%

Another chart that proved of great interest was that showing where the lamps are bought, for it indicated to what extent the hardware dealer and jobber are cutting into the electrical industry:

Lamps bought from the	manufacturer.....	8.2%	
"	"	electrical jobber	43.4%
"	"	electrical retailer	34.6%
"	"	hardware jobber	3.6%
"	"	hardware retailer	2.6%
"	"	central station	18.2%
"	"	other dealers	1.7%



Ten minutes persuasion were necessary to tear Art Rowe away from his arduous task of entertaining the ladies.



Bill Shreve and Garnett Young, of San Francisco, looked in on the business meeting.



Earl Brown, San Francisco, and Mrs. Brown, trying to look sad in front of their new Oldsmobile.



Colonel Cass, Chico, upheld the honors of Northern California in the floating contest Friday afternoon.



Jim Crilly, Habirshaw Wire Co., was out to see that all of the rules of the game were observed by the winner of his cup.



Tom Bennett warming up for his "dollar-dollar-dollar" game with the financiers of the game. Tom has a stance like Babe Ruth.



Cap Kenney, San Francisco, cinched up his belt before taking his licks at Tom Bennett.



R. A. Balzari, Westinghouse, San Francisco, was in his usual happy mood. He usually uses two hands, though.

Mr. Baker closed by stating that there were in the city of Los Angeles 2700 industrial plants, in San Francisco 2352 industrial plants and in the state of California more than 15,000 plants. Of these at least 2700 need better lighting conditions and it is a wonderful opportunity for the electrical contractors of that state. There is a big business waiting for them and the lamp companies will furnish all of the data that the contractor needs to go after this business. Mr. Baker pointed out that ten states have instituted state lighting codes specifying the minimum amount of illumination allowed and recommending the maximum.

STANDARDIZATION OF WIRING METHODS

In reading excerpts from his paper on the "Standardization of Wiring Methods," H. H. Courtright, Fresno, dwelt on the desirability of having a single code or set of rules that would be enforced in all parts of the state so that the contractor bidding on a contract in San Francisco, Los Angeles, or Fresno could use the same type of construction in each case.

The reasons for the incorporation of the National Underwriters Electrical Code with the Electrical Utilization Safety Orders of the California Industrial Accident Commission were outlined by R. L. Eltringham, electrical engineer, California Industrial Accident Commission, who stated that a centralization of power was needed and that a committee of fifty men, representing all branches of the industry, had been appointed and had been working on the consolidation of these two codes for approximately a year. He concluded by saying that there was a real demand on the part of the majority of the industry for this work and that if certain factions decided to try and block this movement there would be a real fight.

BUSINESS MEETING

The business session was held Saturday morning and after the reading of the minutes of the executive session reports were made by the chairmen of the outstanding committees on the "Cost of Selling Motors" and "Sales Policy for Selling Motors." Nine new members were admitted to the association and Riverside was selected as the place for the 1921 convention. The monthly meetings will begin in August at San Diego, the September meeting will be held in Paso Robles and the October meeting in Bakersfield. A motion was made and

carried that a committee of five be appointed from the association to meet with a like committee from the manufacturers and central stations for the purpose of considering the adoption of the dual code. A resolution was passed endorsing the work done by the California Industrial Accident Commission and pledging the unqualified support of the association to the dual code now being prepared. After a lengthy discussion during which Albert Elliot, counsel for the association, was frequently called upon for advice, the following motions were carried:

That the minutes of all meetings of all local associations be written up in duplicate, one copy of which shall be forwarded to the state secretary. This copy to be referred to the counsel of the association and in the event of the opinion of the counsel that any part of the proceedings prove illegal or against the spirit of the association, that part shall be rescinded at once. The other motion was that a committee of three members be appointed to draw up a uniform constitution and by-laws for the government of all of the local associations.

A committee of three was appointed to meet with electrical and mechanical engineers to form plans whereby architects and builders can be shown that it is to the advantage of their clients to have completely wired buildings.

ELECTION OF OFFICERS

The report of the nominating committee was then made and President Clyde L. Chamblin was nominated to retain the office of president for the coming year. He was unanimously re-elected by acclamation and in his speech of acceptance asked for the same whole-hearted cooperation that had been given him during the past year and which had enabled the association to proceed as a business organization along business lines. J. W. Redpath was unanimously re-elected as secretary and treasurer and the following executive committee was elected:

San Francisco—T. J. Bennett and E. E. Brown.
Oakland—R. V. Oyler and L. Spott.
Sacramento—J. Woods.
Northern California—W. H. Cass, Chico.
Stockton—R. Goold.
Sierra—C. E. Osborn, Turlock.
San Joaquin—H. H. Courtright.
San Mateo—M. E. Ryan, Redwood City.
San Jose—H. Guilbert.
Monterey—W. E. Cox, Santa Cruz.
Southern California—D. J. Butts, Los Angeles.
Long Beach—F. O. Lantz, San Bernardino.
Orange Belt—E. J. Field, San Bernardino.
Orange County—J. Cope, Santa Ana.
Imperial Valley—Jerome Aiken.
San Diego—W. H. Cameron.

ENTERTAINMENT

On the night of the banquet the prizes were awarded to the successful contestants in the various sports. The surprise of the evening, however, was the awarding of a gold wrist watch to Mrs. Clyde

Chamblin, from the members of the association in appreciation of the work she had done as the wife of the president of association. The ladies' prizes were awarded by Mrs. Chamblin, Mrs. G. W. Foss of Sacramento receiving the first prize for the whist tournament and Mrs. W. Spencer of Oakland receiving the second prize. The ladies' swimming race was also won by Mrs. Spencer while the prize of a silver tray was awarded to Mr. and Mrs. A. L. Hughes, San Francisco, for the prize dancers. Two of the golf cups were won by Arthur Dahl, San Francisco,—the Crilley cup and the East Bay Electrical Trades Association cup for low net score. Sam Russell, San Francisco, won the cup offered by the state association for low net score by any one outside of the association. The attendance cup was won by the Sacramento local which was represented by seventy per cent of its membership, the presentation speech being made by Teddy de Pas, the "boy orator" of the San Francisco local, who promised the Sacramento local that the cup was only being loaned to them and would be returned to San Francisco at the next meeting.

ALBERT ELLIOT'S ADDRESS

One of the features of the banquet was the address given by Albert Elliot, counsel of the Association, who spoke on "A Few Fundamental Association Truths." Mr. Elliot said in part:

"The foundation of a business association rests upon simple and fundamental truths. The education of the members of such an association is the process of making each one see clearly these fundamental truths so that he will use them in his every day business life.

The motive of self-interest is the strongest possible motive which actuates us in business life. But self-interest should not be confounded

with selfishness. There is a vast difference between these two words and the difference illustrates a part of the work which an association must do in an educational way. Selfishness is small, narrow, short visioned and ruinous, not only to the selfish person but to those also who are unfortunate enough to be his competitors. Self-interest is broad, deep and far visioned. The selfish man seeks some petty advantage today, even though it may result in disaster to himself and others tomorrow. He is his own worst enemy.

The self-interest man who is in business for the good of his family and himself sees very clearly that it is to his best interest to do all in his power to better the business conditions of his city and state. He works for the market of the future and not of the day. He sees clearly that it is good business for him to pull his competitor along with him in his progressive march. And thus the modern business man has resolved that his policy shall be to help his competitor where he can by the interchange of ideas. Through associations this work is furthered in the effort to dignify business methods, so that these shall result in enlightened activity in the place of blind staggering.

We thus see that we have tied together the strongest and finest of human motives, self-interest and mutual helpfulness. Once we can convince a man that his self-interest is along the line of helpfulness to his fellows, his conversion to the association idea is complete. We have full confidence in an association properly managed, because it stands for enlightened self-interest and therefore cooperation.

The man who consults his own enlightened self-interest, sees clearly the goal to which the real association is tending. The human element finally solves the business problem. Man must keep in business touch with man. Ideas are all in man, but they are only used when rubbed out of him by his associationship with his fellows. This is evidently the plan of the great Architect of the Universe. It does not matter what fine thoughts are in a man's soul if he never uses them. Association with fellow men makes us use the ideas. We pity the man who never learns from his fellows.

The function of an association is the bringing to the surface of the minds of business men the submerged ideas. You learn from your competitors in business when you associate with them. You need the association and the association needs you. You can help your competitors with profit to yourself. This is both good morals, good business and good sense."



Grover Anderson, EACO, San Francisco, didn't bite into a green olive—he simply made the last hole in ten.



George Curtiss, ERMSCO San Francisco, was smiling over his easy defeat of Paul Butte when he came into club house.



There wasn't really any ball there, but Garnett Young simply wanted to show how good his stance was.



The chairman of the entertainment committee certainly has a hard job at conventions, as is shown by the picture. Reading from left to right, Miss Wiseman, Mrs. E. A. Gearhart, Mrs. D. J. Butts, Mrs. T. J. Bennett, Mrs. Geo. Curtiss, Mrs. J. C. Hobrecht, Miss H. E. Marrow, Mrs. Romaine Myers, Mrs. Geo. Compton, Mrs. Clyde Chamblin, Mrs. C. B. Kenney.



"The early bird catches the worm." So Harry Garbutt (left) and Sam Russell (right) set out before lunch for the links, with the result that Sam won the prize. Harry lost his smile somewhere on the road but Sam still had his when he received the cup at the banquet.

Problem Course in Electricity

BY H. H. BLISS

(The elements of electricity as presented serially in the Journal of Electricity last year met with so much favorable attention that arrangements have been made with the author to follow up the series with another course laying special emphasis on practical problem work. The author is supervisor of the department of vocational education of Nevada.—The Editor.)

RELATIONS IN THE SIMPLE CIRCUIT

The Circuit.—From the meter cabinet, where the lighting circuit enters a residence, two wires run to any particular lamp. Close to the meter are to be found "fuses" through which the current goes to the wires leading to the lamp. If either fuse is "blown" (that is, if the metallic conductor within it is melted in two), it is impossible to light the lamp. This verifies the statement that there must be a complete conducting circuit to carry the current both to the apparatus and back to the source of energy.

Porcelain knobs and rubber coverings upon the two wires are used as "insulators" to prevent the escape of the current before it reaches the lamp.

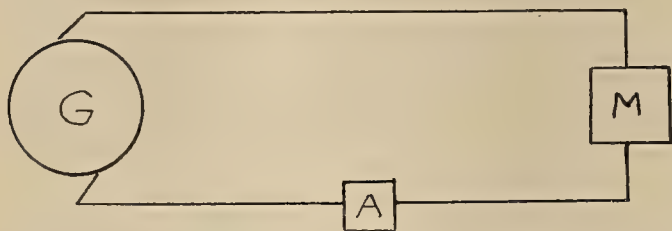


Figure A.—Showing a generator, on the left, connected through an ammeter with a motor, at the right.

If the insulation becomes injured, so that one bare wire touches the other, the current takes the "short circuit" and returns to the generator without passing through the lamp. In such a case the flow of electricity is usually so heavy that it blows one or both fuses, and thus it is automatically stopped. Fuses are installed for this purpose, because large currents in house wiring are apt to heat the wires to such an extent as to start a fire.

Connection Diagrams.—It is possible to indicate by means of a photograph how the current in any given circuit is carried from one piece of apparatus to another, but a more effective way is to use a simple wiring diagram such as Fig. A. This shows a generator (at the left) connected through an ammeter with a motor (at the right). Note the circle with two slanting marks, which is a conventional sign for a direct current generator, and the use of rectangles with initial letters to indicate motor and ammeter. The conductors are drawn as straight lines, though the actual wires may be very crooked.

Fig. B illustrates another circuit, containing a battery of four "cells," a voltmeter, an ammeter, a double pole single throw switch and a bell. As the switch is open, no current flows to the bell. (The two blades of the switch are connected at the top by a bar of insulating material, so that there is no short circuit there.)

Amperes and Ohms.—Various pieces of apparatus, including a lamp, a heater and a coil of wire, were connected in turn to the lighting circuit in a

residence. By means of an ammeter in the line it was observed that the heater took a current of 5 amperes, the lamp $\frac{1}{2}$ ampere, and the coil 8 amperes. Evidently the resistance each presented was different from that of the other two. In the lamp the number of "ohms" (the measure of resistance) was obviously greater than the number in the heater, for the lamp took far less current. The coil, on the other hand, took greater current, and hence had less ohms than the heater. **The greater the resistance, the less the current.**

Voltage.—When this heater was tested in another house, it was found to take 10 amperes, whereas it had formerly taken only five. Its resist-

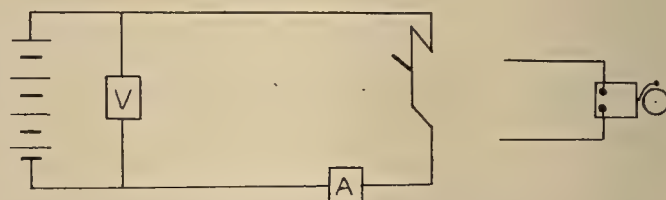


Figure B.—Diagram of a circuit which contains a battery of four "cells," an ammeter, a double pole single throw switch and a bell.

ance had not changed; hence it appeared that the pressure driving the current was greater. In fact, a voltmeter showed that the "electromotive force" (e.m.f.) was 220 volts in the second house and only 110 volts in the first. In a later test with a 22-volt storage battery the heater took only one ampere. The conclusion is that, with a given resistance, **the current is proportional to the pressure.**

What, then, would be the current if this heater were connected to a 55-volt circuit? Since the voltage is $\frac{1}{2}$ of 110, the current will be half as great as on the 110-volt circuit, or 2.5 amperes. Further, if we wished a current of 20 amperes, four times the current for 110 volts, we should have to apply 4×110 , or 440 volts.

The Fundamental Law.—One volt is defined as the pressure needed to drive one ampere through one ohm. It follows logically that it takes 3 volts to drive one ampere through 3 ohms, and this is readily verified by experiment. Then to drive 2 amperes through 3 ohms requires twice as much pressure, or 6 volts. If the resistance were 7 ohms, it would take 7 volts for one ampere, and 28 volts for 4 amperes. In general, **number of volts = number of amperes \times number of ohms.** This is Ohm's Law, and it is absolutely necessary to know it thoroughly. A student who gets it twisted (for instance, saying "Amperes = volts \times ohms") not only fails to understand the logical relations of electrical quantities but also has endless difficulty in attempting to work practical problems. **Volts = amperes \times ohms.**

Examples.—In a certain automobile a current of 5 amperes flows through an electromagnet. Its resistance is 1.2 ohms. What is the voltage of the storage battery which supplies the current? Solution: Voltage = $5 \times 1.2 = 6$ volts.

What is the voltage of a "White Mazda" of 270 ohms resistance which is supposed to take .43 ampere? Solution: $.43 \times 270 = 116$ volts.

To Calculate the Current.—How many amperes flow through a 4-ohm coil connected to a 12-volt starting and lighting battery? By Ohm's Law, $12 = \text{amperes} \times 4$. Obviously the answer is 3 amperes, obtained by a process of division. **Amperes = volts \div ohms.** This is another aspect of the fundamental law, and it also should be memorized as a formula.

What current is taken by a 24-ohm heater on a 108-volt circuit? Solution: $108/24 = 4.5$ amperes.

A certain telegraph sounder has 50 ohms resistance. What current flows if it is connected to a dry battery (1.5 volts)? $1.5/50 = .03$ amperes.

Figuring Resistance.—The most common method of finding the number of ohms in a piece of electrical apparatus is to connect it to a circuit of known voltage and measure the current it takes. For example, the pair of wires leading from a telephone station to a private branch exchange are "shorted" or connected together at the far end, and attached to the 24-volt central battery at the station. What is the resistance of the line if the ammeter reads 2 amperes? Here $24 = 2 \times \text{ohms}$, or the ohms = $24 \div 2 = 12$. Thus we have the third aspect of the

law: **Ohms = volts \div amperes, or resistance = electromotive force \div current.**

To drive 250 amperes through a certain copper bar takes only .4 volt pressure. What is its resistance? $.4/250 = .0016$ ohm.

Problems

1. What is the voltage of the battery sending 1.8 amperes through a house bell of 2.5 ohms resistance?
2. When 380 volts pressure is applied to a certain controller, a current of 69 amperes flows. What is the resistance of the controller?
3. How many ohms are there in a piece of German silver wire through which a 2-volt battery sends .155 ampere?
4. The field circuit of a certain generator has 48 ohms resistance. Calculate the current when 120 volts are applied.
5. A workman accidentally dropped his pliers upon the wires leading from an electroplating generator. The resistance of the short circuit was .074 ohm. What was the voltage of the generator if the current which flowed through the pliers was 46 amperes?
6. The resistance of a telegraph circuit was 2100 ohms. Calculate the current when a voltage of 81 was used in signaling.
7. What is the resistance of a 220-volt carbon lamp which takes a current of .27 ampere?
8. A current of .92 ampere was sent through a long glass tube full of mercury, the metal having a resistance of 3.3 ohms. What was the electromotive force?
9. When 4.1 volts were applied to the armature of a 10 horsepower motor, the current was found to be 58.5 amperes. Calculate the armature resistance.
10. To test the effect of change of temperature, a coil of copper wire was cooled to freezing with ice and then heated to the boiling point of water. A 6-volt storage battery was connected to the coil all the time. The current was observed to drop from 1.2 amperes to .86 ampere as the wire was warmed. What was the resistance in each case?

The Reinforced Concrete Arch Dam

BY F. A. NOETZLI

(Foreign practice in the designing and building of dams has a continual, inherent interest, but for the West, where electrical development depends so largely on water power, this branch of engineering is of especial importance. The following article gives technical details of a recently constructed dam in Sweden. The author is engineer with the Beckman & Linden Company. —The Editor.)

Although a great number of arch dams of reduced gravity section have been built successfully in the United States, very few dams of this type have been constructed as yet in Europe. Notwithstanding the early and well-known example of the Zola Dam in France, it was only recently that the desire or the compelling necessity for increased economy brought the slender arch dam into more general favor.

An arch dam of fairly slender cross section was recently completed in Sweden,* to divert the waters of the Gide river for a hydroelectric power development. The dam has a maximum height of about 58 feet and is 140 feet long at the crest. The thickness at the bottom is 17.7 feet and at the top 6.5 feet. The radius of the centerline of the arches varies from $R = 63$ feet at the bottom to $R = 95$ feet at the crest, thus allowing a considerable saving in dam material. The dam body is heavily reinforced for temperature and shrinkage stresses.

Along the crest there are a series of movable gates, whereby the water level is raised for an addi-

tional 11.5 feet. In case of floods these gates are opened and the dam will be over-topped by about 12 feet of water.

Theory of Construction —

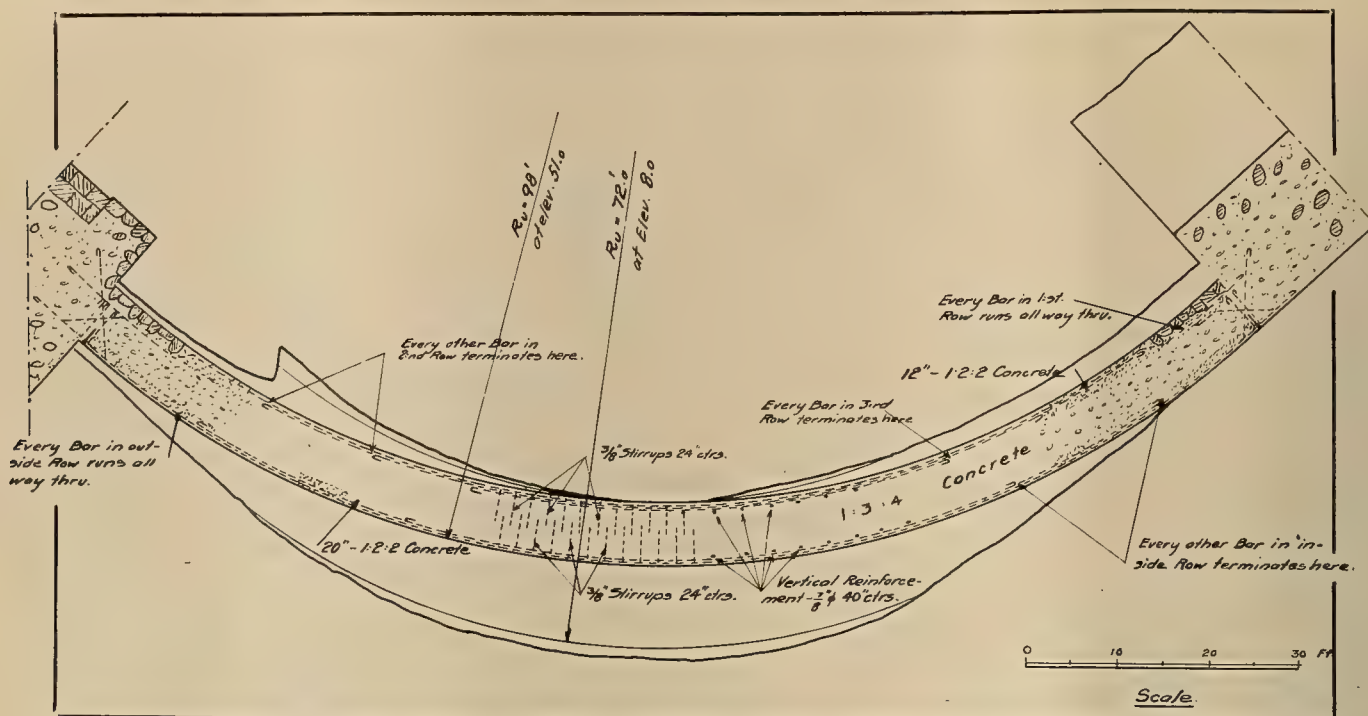
The design of this dam was based upon the usual assumption that all the water pressure be supported by horizontal arching. The vertical cantilever action which necessarily has to occur even in dams of slender cross section was simply assumed as increasing the safety of the structure to an unknown degree.

On the other hand, the stresses in the horizontal arches were determined in a similar way as for concrete arches for bridges. Therefore not only the direct stresses due to the water and ice pressure were considered, but also the stresses from shrinkage in the concrete and those due to changes in the temperature of the arches.

Temperature Consideration —

For the purpose of design it was assumed that the shrinkage of the concrete was equivalent to a decrease in temperature of 18 degrees Fahr. in the upper portion of the dam, and 9 degrees Fahr. in the

*See: Bo Hellstrom, Teknisk Tidskrift, No. 3, 1919.



Cross section of concrete arch dam, showing special features of reinforcement to withstand temperature changes and excessive tensile stresses.

lower portion. The seasonal changes in the temperature of the arches were assumed as a linear function of the combined action of the changes of water and mean air temperature. The maximum range of arch temperature considered was the variation of $+27$ degrees Fahr. in summer to -31 degrees Fahr. in very cold winters, measured from the pouring temperature of the concrete.

By considering the horizontal arches as hinged at the side abutments, the stresses in the arches were obtained to somewhat over 850 lbs. per sq. in. in the concrete and about 25,000 lbs. per sq. in. in the steel.

This example of arch dams presents two most striking features: first, the heavy reinforcement of the horizontal arches from the crest of the dam to little above the foundation, and second, the high unit stresses occurring under the assumptions made.

As stated previously, the design of this dam was made with due consideration of temperature and shrinkage deformations, which, as is well known, occur to a very marked degree in all concrete arch dams as shown by the occasional occurrence of vertical cracks during winters. It is a question still in dispute how much the mean temperature of a slender arch dam varies during a year, and the measuring of temperature changes in dams already built is most desirable. In the case of this dam the designer probably had good reasons for assuming the rather high variation of 58 degrees Fahr. Enough steel was placed in the zones of tension to take care of the occurring tensile stresses. The allowed stresses of 25,000 lbs. per sq. in. in the steel and 850 lbs. per sq. in. in the concrete are rather high, though perhaps not excessive in this case in view of the extreme variation of temperature considered.

Future Dam Construction —

Very few of our California arch dams have been

reinforced according to scientific methods as used, for instance, in the design of arch bridges. As a consequence many of these dams have seriously cracked under excessive tension stresses, so that, when the arch comes under pressure, the compression forces are transmitted across rough broken surfaces. In time this may lead to serious injury to the two surfaces of each crack and to gradual deterioration of the adjacent concrete. It will therefore be most desirable for future designs of arch dams to pay more attention also to the stresses resulting from temperature and shrinkage deformations.

CANADA'S ELECTRICAL-APPARATUS INDUSTRY

Figures of the industrial census taken by the Canadian Bureau of Statistics in 1918 are being made public as the compilations for the different industries are completed. One of the bureau's most recent bulletins deals with the manufacture of electrical apparatus within the Dominion. The returns show a total of 68 plants engaged in the manufacture of electrical goods of various kinds, 42 of them being located in Ontario, 13 in Quebec, 7 in Manitoba, 3 in British Columbia, 2 in Alberta, and 1 in Saskatchewan. These 68 plants represent a total capital investment of \$43,285,405—Ontario leading with \$26,426,129, Quebec following with \$16,525,454, Manitoba being credited with \$253,026, British Columbia with \$42,881, Alberta with \$19,736, and Saskatchewan with \$18,179. Of the total capital \$10,636,572 was invested in land, buildings, and fixtures, \$6,518,132 in machinery and tools, \$17,071,528 in materials, stocks in process, finished products, fuel, and miscellaneous supplies on hand, and \$9,059,173 represented working capital. In 1918 the industry had 6,595 male and 2,268 female employees, to whom it paid \$8,456,705 in salaries and wages.

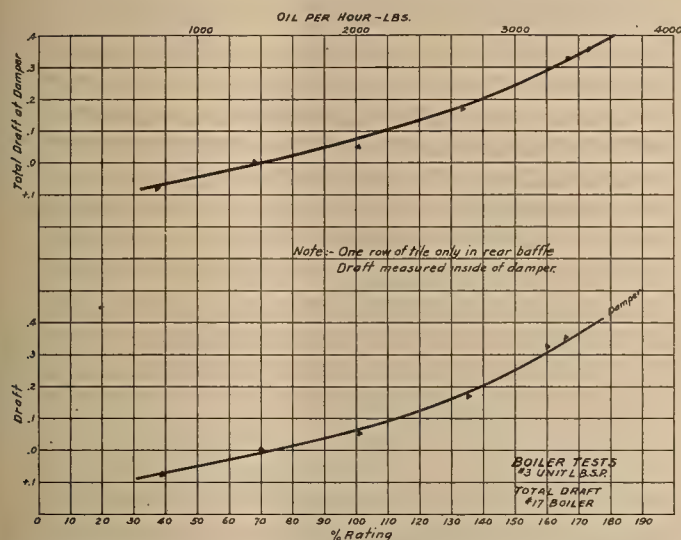
Steam Power Plant Tests—I.

BY H. L. DOOLITTLE

(Tests made in steam electric plants are of the highest importance in connection with the efficient operation so necessary for the conservation of fuel oil at this time. Following is the first instalment of interesting data on tests made in a large Western plant. The author is steam power plant specialist with the Southern California Edison Company.—The Editor.)

The following report covers a series of tests conducted on the boilers at the Long Beach steam plant of the Southern California Edison Company. These tests extended over a period of approximately ten months.

The Long Beach steam plant is located at the



A relationship of total draft at the ammeter with the oil consumed per hour; compared also with the percentage of rating at which the boiler is operated. Note that the draft is made inside of the damper.

Long Beach inner harbor, Long Beach, California, and consists of the following equipment:

No. 1 Unit—placed in operation August 20, 1911, consisting of: 1—12,000-kw. General Electric Company vertical Curtis turbo-generator running at 750 r.p.m.; 8—777.5-hp. Stirling boilers; duplex feed pumps; turbine-driven exciter; engine-driven centrifugal circulating pump. All auxiliaries steam-driven excepting spare hot well and oil drain pumps which are motor-driven.

No. 2 Unit—placed in operation February 2, 1913, consisting of: 1—15,000-kw. General Electric Company vertical Curtis turbo-generator running at 750 r.p.m.; 8—777.5-hp. Stirling boilers; steam-turbine-driven centrifugal feed pumps; turbine-driven exciter; steam-turbine-driven centrifugal circulating pump. All auxiliaries steam-driven excepting spare hot well and oil drain pumps which are motor-driven.

No. 3 Unit—placed in operation March 30, 1914, consisting of: 1—20,000-kw. General Electric Company vertical Curtis turbo-generator running at 750 r.p.m.; 8—850-hp. Stirling boilers fitted with Sturtevant economizers; motor-driven exciter; centrifugal boiler feed pumps; centrifugal circulating pump. Auxiliaries motor-driven with the exception of the fuel oil pumps which are duplex steam pumps.

All boilers are equipped with four Hammel oil burners and B. & W. U tube superheaters.

All units operate at the normal pressure of 225 gauge and 125° F. superheat.

Method of Testing —

In general all tests extended over a period of from seven to eight hours, all observations being taken every fifteen minutes. Such observations as weighing of oil and water and the measurement of kilowatt-hours were balanced every hour. It was necessary for every observer to make a dozen or

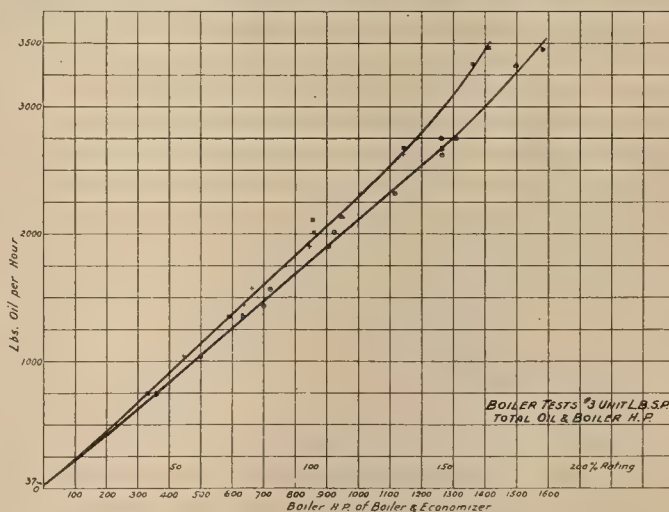
more different observations but as these observations were always made in the same order, it resulted in obtaining readings which were always practically fifteen minutes apart.

All temperatures, except the stack temperatures, were taken with mercurial thermometers calibrated by means of a standard thermometer.

All pressure gauges were calibrated with the dead weight gauge meter. Small differences in pressure and small pressures were measured with mercury U tubes.

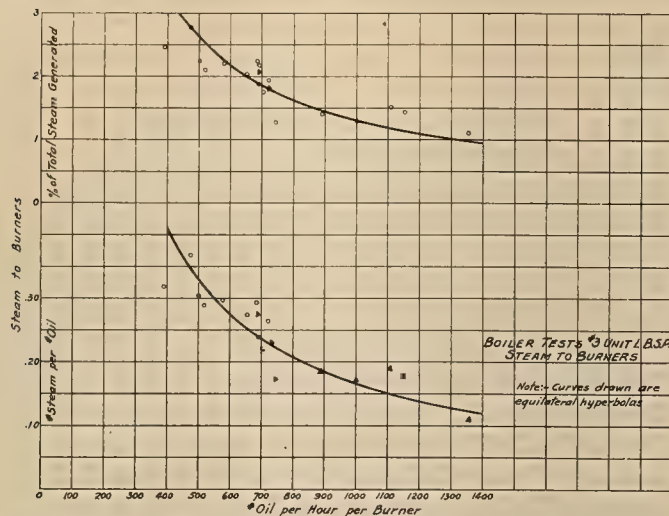
The vacuum in the condensers was measured by means of absolute pressure gauges, thus eliminating the effect of varying barometer.

Stack temperatures for boiler tests were measured by means of a resistance thermometer consisting of copper wire installed in the path of the flue gases. The resistance of this wire was obtained by taking a cold reading after the wire was installed. Temperatures were calculated from the variation in the resistance of the wire. It was hoped that this method of measuring the flue gas temperature would



The pounds of oil per hour shown in relationship with boiler hp. of boiler and economizer combined.

be very accurate inasmuch as the wire was strung back and forth across the flue so as to measure the average gas temperature. It was found, however, that this method of measurement gave more or less erratic results which must be due to the varying velocities of the gas flowing past the wire. It appears that in general this method would give results that are too low, on account of the fact that the gas in the upper part of the flue is the hottest and travels with the greatest velocity. It is, however, believed that this method gives as accurate results as can be obtained by means of a thermometer or a pyrometer as either of these methods would be subject to the same error due to varying gas velocities. The ideal method of measuring gas temperatures



Steam to burners utilized in furnace operation shown in relationship with the oil per hour per burner. Note the interesting result obtained is that the curves are thus shown to be equilateral hyperbolas.

appears to be some system by which the product of the velocity of the gas by its temperature, could be averaged for various sections of the flue.

The stack temperatures for the plant tests were obtained by means of a resistance thermometer consisting of a small coil of copper wire placed on the end of a piece of iron pipe. This resistance thermometer was used to take readings at different points across a horizontal section of the stack located at approximately the roof line.

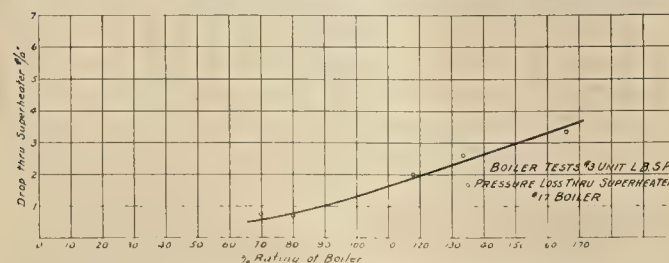
The readings of the resistance of the coil were checked at least twice a day against a cold reading.

All electrical readings were taken with standard test meters by an observer furnished by the Test Department. Kilowatt-hour outputs of the main units were measured by rotative watthour meters. The amounts of air leakage into the condensers was measured by means of a gasometer sufficiently counter-weighted to give the volume of the air at atmospheric pressure. The temperature of the air discharged by the air pump was also measured so that the air leakage could be corrected to standard temperature.

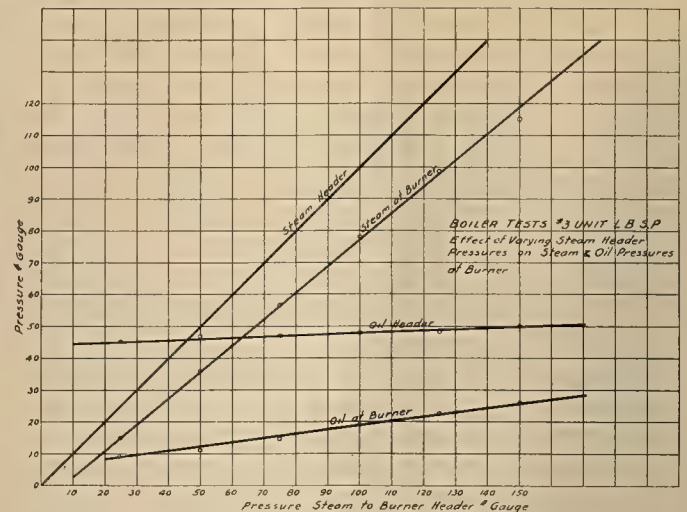
Flue gas analyses were made with a portable Orsat flue gas testing apparatus.

Fuel oil was weighed on a 5000-lb. Fairbanks-Morse portable platform scale calibrated in place against standard weights.

Condensate from the No. 3 turbine and total water fed to boilers for the No. 1 and No. 2 unit tests were weighed on two 15-ton platform scales weighing to five lbs. Condensate from the No. 1 and No. 2 units was measured by Worthington water weighers. These weighers operate on the principle



Pressure loss through the superheater in its relationship with the rating of the boiler.



A relationship showing the effect of varying the steam header pressure with the steam and oil pressures at the burner.

of a bucket automatically dumped after it has been filled with a given weight of water. They were calibrated by measuring several dumps in a receiving tank. It was, however, found that during the test the readings given by these meters were entirely unreliable. This is probably caused by the meters dumping a greater or less amount of water depending upon the rate of flow into the meter.

The steam required for atomizing the oil in the burners was measured by installing an orifice between two flanges in the steam pipe. The drop in pressure through this orifice was measured by means of a mercury U tube. The orifice was calibrated by condensing the steam flow through the orifice during a given period of time in a tank of water and measuring the increase in weight.

In the No. 3 unit it was necessary to raise the temperature of the condensate going to the economizers to approximately 100° in order to prevent "sweating" of the economizer tubes. This heating was



A relationship showing the varying draft of a boiler when operated at 105% rating in its relationship with draft at the damper and the temperatures of the stack.

done by means of live steam introduced into the suction pipe of the feed pump. The temperature and pressure of this live steam was observed and the amount of steam used calculated by means of the temperature rise of the feed water.

Four samples of oil were taken. These samples were composed of small amounts of oil taken approximately every hour from the oil being fed to the boilers. The analyses of the oil samples were made by Wrana King & Company, chemists, Los Angeles.

The water evaporated during the boiler tests was obtained by correcting the total water weighed to the boilers for feed pump leakage, amounting to 75 lbs. per hour. In all tests the water evaporated was corrected for the height of the water in the boiler gauge glasses, the deduction amounting to 670 lbs. per inch.

In addition to weighing the total feed to the boilers, this feed was also measured by means of Venturi meters which are permanently installed in the feed lines. Circulating water to the condensers was measured by means of a Venturi meter for the No. 3 unit, and General Electric Company water flow meters for No. 1 and No. 2 units.

Total steam generated was measured by General Electric Company steam flow meters permanently installed in the main steam headers in addition to the calculation made from total water fed to boilers.

A series of nineteen boiler tests was conducted on the boilers of the No. 3 unit in order to determine the most economical load at which the boilers should be operated. In the test on a single boiler, one boiler of a battery was used with the other boiler of the battery shut down. This necessarily increased the radiation losses of the boiler being tested but it was much easier to conduct the test in this manner on account of the fact that one economizer is installed to take care of two boilers. The tests made on two boilers were made with both boilers in one battery operating.

In all of the boiler tests complete readings of the temperatures, pressures and water fed to the boilers were taken so as to determine the efficiency of the boiler alone and also the combined efficiency of the boiler and economizers. All of the boiler tests, excepting that made on 3/9/15, were made with Hammel oil burners.

The first ten tests were conducted on the boiler with the furnace as originally installed by the manufacturer. The remaining tests were made on a boiler with the furnace rebuilt to accommodate three instead of four burners. In addition to rebuilding the furnace, the boiler for the last series of tests had a slight modification in the baffling of the rear pass. This modification consisted in removing two rows of 12-in. tile directly in front of the damper opening.

In this series of boiler tests we endeavored to determine the efficiency of both the boiler and economizer at different loads, the maximum and minimum loads that the boiler was capable of carrying, the effect of hot water entering the economizer, the efficiency of the boiler during a swinging load, and also the oil required to bring the boiler up to header pressure after being shut down for several hours.

ILLUMINATION IN A STOCK SHOW BUILDING

BY F. D. WEBER

(The proper lighting of public buildings, fair grounds, and so forth, is a study in itself, and is determined by various factors of efficiency, safety and effectiveness. Following is an account of the lighting arrangements in a large stock-show building in the Northwest, by the electrical engineer for the Oregon Fire Insurance Rating Bureau.—The Editor.)

The ninth annual stock show of the Pacific International Live Stock Exposition which took place some time ago in Portland, was held in the largest stock-show building exclusively devoted to such purposes in the world. The big pavilion covers 71½ acres of a 15-acre tract, leaving 7½ acres for roadways, automobile parking space and ornamental strips.

The central feature of the stock-show building is a huge stadium of red brick and ivory-toned stone, having a massive portico with eight columns and a



The main arena of the stock-show building, with a seating capacity which can be made to accommodate 10,000 persons.

huge glass dome. This big stadium is flanked by two great wings of heavy timber construction, the color scheme of red and ivory being carried out in these extensions.

Just under the great central dome the interior feature is a great pavilion 200 feet wide by 200 feet long, in which seats have been provided for 8,000 people, with a 100 by 200-foot arena in the center.

Flanking the main arena on either side there are two other arenas, each capable of seating 1,000 people and with a spacious sales ring in the center.

In the big horse barn at the rear of the main stadium there are stalls for 500 horses; there is a sheep section which will take care of 4000 animals and swine sections that will comfortably house an equal number.

An abundant supply of running water, both hot and cold, is provided in all parts of the building, so that the animals may be kept in show condition and ready for exhibition at any time. Special consideration has been given to sanitation arrangements and scientific ventilation. The lighting problem has been solved by a series of slanting roof sections, with glass inserts. Spacious offices and rest rooms have been provided near the entrance of the building.

In the main arena all electric wiring is in rigid iron conduit, and the balance is of the "knob and tube" type of construction.

Power (single phase, 3-wire, 110-220-volt), is furnished by the Portland Railway, Light and Power

Company. A transformer vault is located just outside the building in the ground. Service is brought into a main line cabinet, and a switch located under one tier of seats of the main arena. The service consists of three 600,000 cir. mil. rubber covered cables. From the main distribution center sub-feeders are run to various cabinets located in the pavilions.

The main arena is illuminated by 45 Benjamin 500-watt fluted bowl reflectors, while in the sections over the boxes and seats, Benjamin shallow bowl reflectors are used. The above lights are installed on 50 separate circuits served from two cabinets containing 14 and 36 circuits respectively.

On the dome of the building there is installed one 500-watt and one 200-watt lamp, and in the entrance there are four large bronze fixtures containing 100-watt lamps. Also in the face of the building,

worked in with the architecture, are installed 36 flush receptacles.

The building, exclusive of the main arena, is divided into pavilions, A, B, C, D and E. In pavilion A and E, where the cattle stalls are located, there are 6 circuits and 35 100-watt lights equipped with Benjamin reflectors. In pavilion B (hog pens), there are 4 circuits and 16 100-watt lights equipped with the same type of reflector as in pavilion A. Pavilion C has 10 circuits—4 300-watt lights and 10 100-watt lights equipped with Benjamin reflectors, also 32 60-watt lights in Benjamin deep bowl reflectors over wash racks, passageway, etc. In pavilion D are the sheep pens, with electrical equipment the same as in pavilion B.

All of the electrical equipment was installed by the National Electric Company of Portland, Oregon.

Steam Turbine Characteristics

BY WILLIS T. BATCHELLER

(The causes of losses in steam turbines are among the operating characteristics with which all engineers must be familiar. A brief and helpful summary of these is here given by the electrical engineer of the Seattle Lighting Department, in the fifth of a series of articles on steam turbines.—The Editor.)

LOSSES IN STEAM TURBINES

Steam turbine losses may be divided into five classes.

Friction

Losses due to friction occur in the nozzles or stationary blades and in the rotor vanes. They are proportional to the exposed area and the square of the velocity. They have the effect of reducing the velocity of the steam and increasing the heat content.

Eddies

Shocks, eddies and vibration cause losses, especially at partial admission.

Clearance

In impulse turbines clearance losses occur between the shaft and diaphragm carrying the guide blades. In reaction turbines they occur in the space between the rotor vanes and the casing. This leakage steam supplies heat to the working steam, making it drier.

Windage

This loss is due to the rotation of the moving blades in the casing. In reaction turbines all the vane spaces in the guide vanes and rotor wheels are filled with steam and friction losses are small. Windage is proportional to the square of the diameter or to the wheel surface.

Radiation

As radiation losses are proportional to the difference of temperature between the turbine and the surrounding air, they are greater in the high pressure part of the turbine where the temperature is higher.

Centrifugal Force on Water

Water in damp steam, set in motion by centrifugal force, causes a loss of energy. This can be partially overcome by efficient drainage of the working chamber.

Exhaust

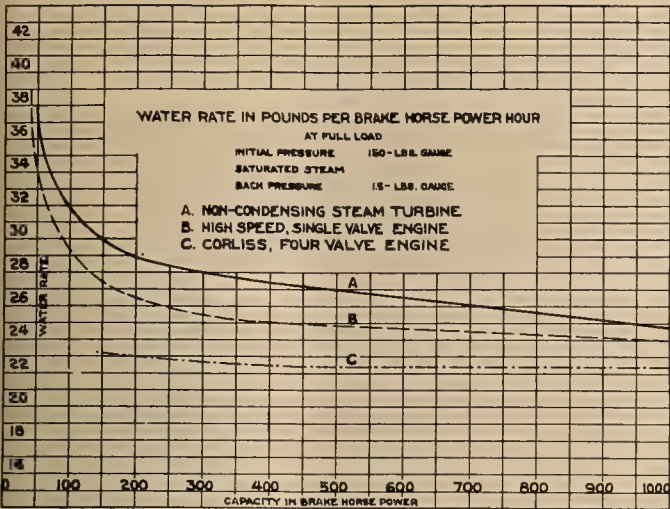
Steam on leaving the turbine still possesses a certain velocity and is capable of doing an amount of useful work equal to the velocity squared divided by two times g per pound of steam.

Economy

On account of the wide variation in operating conditions encountered, the comparison of the water rates of reciprocating engines and steam turbines must necessarily be limited to some given set of conditions and to full load economies. In the case of non-condensing units and in the smaller sizes the reciprocating engine is more economical. With high pressure, high vacuum condensing units, the steam turbine economy is better. However, the small steam turbine has become standard for many purposes, especially in large plants, on account of its numerous advantages aside from the water rate. The accompanying curves show the comparison in steam economy between the average non-condensing engines and steam turbines and also between condensing engines and steam turbines. They show that the non-condensing high speed engine has a slight advantage. On the other hand the condensing steam turbine is more efficient than the compound, condensing steam engine in sizes of one thousand horsepower and larger. The curves must necessarily show average results for the steam conditions given, and special cases will vary from the values indicated.

Applications

The most extensive use made of large steam turbines is to drive electric generators to which they are directly connected. Individual electric motors for driving the various pieces of machinery in mines, saw mills and industrial plants of all kinds, make the ideal system from the standpoint of flexibility and economy, and are often made possible by the installation of a steam turbine driven generator. Steam



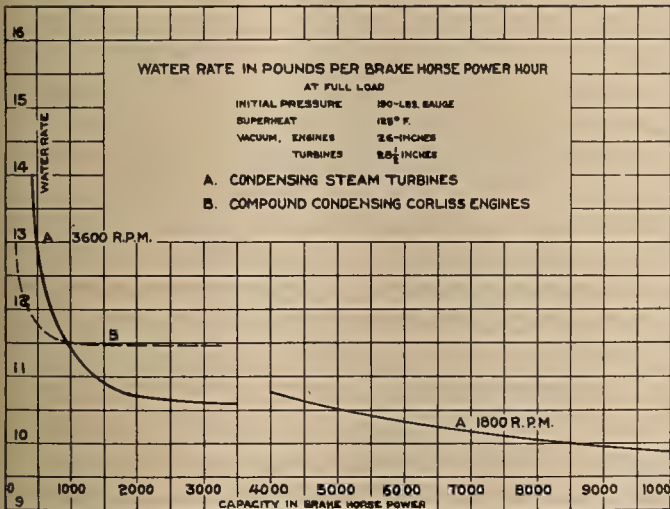
Curves showing comparison in steam economy between the average non-condensing engines and steam turbines. The non-condensing high speed engine has a slight advantage.

turbines for ship propulsion are rapidly superseding marine reciprocating engines, particularly in the larger sizes.

Small steam turbines are used under the same conditions as electric motors, for driving fans, blowers, pumps, generators, etc.

Advantages

The principal advantages of the steam turbine are low first cost, low maintenance and operation



Curve showing comparison in steam economy between condensing engines and steam turbines. The condensing steam turbine is more efficient than the compound condensing steam engine in sizes of 1000 hp. and larger.

costs, economy of space and foundation, freedom from vibration, uniform angular velocity, absence of oil in condensed steam, and high efficiencies for large variations in load.

The author wishes to acknowledge the use of material obtained from Gebhart's Steam Power Plant Engineering, Thomas' Steam Turbines, Leland's Steam Turbines, Marks' Handbook, and information obtained directly from the turbine manufacturers.

Western Ideas

STICKERS clipped onto the posters which are sent to electrical dealers do a great deal to insure the posters being put up directly in the window or in some other part of the store. When the average dealer receives a poster, he finds nothing handy with which to put it up, and so usually puts it away for

*Use these Stickers to Put
the Poster in Your Window
It Brings Business*

The stickers which are attached to posters to insure their being put up in the display window without delay.

possible future use. The result is that it is allowed to lie around until it finally becomes old and dingy and is thrown into the waste basket.

A certain Western supply house attaches the stickers shown here to every poster they send out so that the slip of paper will remind the dealer that it is valuable to his business to have the poster in his store and at the same time will offer him a practical means of sticking it up.

IF YOU ARE MOVING don't lose perfectly good advertising time and opportunity by allowing your window to stand vacant during the ten or twelve moving days. The Lewis Electric Company of Modesto, California, which moved recently into the new shop shown in the picture below, arranged their window display before any other part of the store so that those who passed by became acquainted with the store before its doors were actually open for business. In this way moving from one shop to another does not mean even a temporary loss of business. It can, on the other hand, be carried out as an excellent advertising program, so that increased trade is found waiting for the doors to open.



A picture of the new home of the Lewis Electric Company, Modesto, California, showing the display windows which, for advertising purposes, were arranged before any other part of the shop.

COMING CONVENTIONS

- American Institute of Electrical Engineers —
— Portland, Oregon, July 21-24

Northwest Electric Light and Power Association—
— Spokane, Washington, September 15-18
- American Society of Civil Engineers —
— Portland, Oregon, August 10-11

SPARKS—Current Facts, Figures and Fancy

(On this page you can learn how much business an all-day sucker factory can do per day; why March 4th is inauguration day; what electricity can do to purify milk and to aid the music teacher and what is being planned to develop hydroelectric power in the Holy Land. The last words on the subject of movie theatres and the manufacture of women's clothing are also set forth along with facts concerning the production of oil in California and the present day currency of Poland.—The Editor)

There are now three automobiles to every railroad freight car.

* * *

In England the names of towns are painted on the roofs of the railroad stations to guide airmen.

* * *

Light travels at the rate of 186,400 miles a second, electricity at the rate of 248,500 miles a second.

* * *

An all-day sucker factory in the middle west does \$10,000 worth of business a day, making an article which retails for one cent.

* * *

Seattle is building the largest commercial pier in the world. It is 2,560 feet long and 360 feet wide and will be able to dock eleven ocean-going vessels at one time.

* * *

The total amount of the domestic exports of typewriter ribbons from the United States during 1919 amounted to \$808,259. France and Argentina took the largest shipments.

* * *

March 4th, the date fixed for the inauguration of Presidents of the United States, was selected because Sunday seldom falls on this date—only three times during the present century, 1917, 1945, 1973.

* * *

Potatoes are now being used as the standard currency in certain remote agricultural districts of Poland. It has been found that the value of the potato fluctuates far less than any of the various types of paper money which are in circulation.

* * *

A certain new device makes it possible for the vocalist to hear the effect of his own voice the same as it sounds in the auditorium. A transmitter having a battery in its body is strapped on the chest and from this, cords lead to a telephone head-band.

* * *

The last word in picture theatre construction is nothing less than a sound-proof, glass-enclosed room for mothers who have crying babies. In this room, which is in full view of the stage, mothers may congregate and enjoy the show even though the youngsters cry in infantile chorus.

* * *

A most attractive illuminated aquarium is the result of a glass container with a suitably mounted incandescent light in the bottom. No gravel is used, plants being attached to miniature turtles and rocks.

The light shining through the glass on the fishes and vegetation gives a most pleasing effect.

* * *

The Swedish parliament has definitely approved of the electrification of the state railways between Stockholm and Goteborg and has appropriated for the work 23,000,000 crowns (normally \$6,164,000). It is expected that the conversion from steam to electrical operation will be completed by 1925.

* * *

Women's clothing prices are sky-rocketing so in London that the Government is planning to supervise the manufacture of half a million standard costumes and coat frocks. Paris is also putting out "national" ready-made clothing at the rate of 25,000 suits monthly at 110 francs a suit. The clothing house prices are up to 250 francs.

* * *

Figures show that the cost of the power house repair work has been considerably increased during the past five years. The cost of rewinding a 25-hp. armature has increased from \$75 to \$160, the cost of removing a crosshead for a horizontal engine has increased from \$180 to \$430, and the cost of renewing a valve spindle has increased from \$25 to \$81.25.

* * *

An electrically operated embroidery machine recently on exhibition in a large western department store, is equipped to do embroidery in silk, metal, wool and braid. This works with such rapidity that designs which, if done by hand, would take three months, are easily finished in two hours' time. Many patterns are possible also which cannot be worked by hand.

* * *

The production of oil in the California fields during 1919 increased 1,517,690 barrels, or 1½% over the output of the previous year. The outstanding feature of California oil production is its fairly constant rate for several years. Such a condition may be expected to continue for several years, and shortage of oil or its products, will be due to increased consumption.

* * *

Milk can be freed from a pathogenic bacteria through a recently discovered electrical process. Under this treatment the temperature of the milk is not raised higher than 64 degrees C. yet the percentage of bacteria reduction is 99.93. The keeping power of the milk is considerably increased, the taste is not altered, and so far as chemical examination can determine, the properties of the milk are not in any way impaired.

PERSONALS



S. H. Taylor, general manager of the Electric Railway and Manufacturers' Supply Company, has been appointed secretary of the Pacific Coast Section of the National Electric Light Association by President L. H. Newbert. Mr. Taylor has long been associated with the commercial side of the electrical industry on the Pacific Coast as he has been connected with the Electric Railway and Manufacturers Supply Co. since the time it was founded in 1892. Mr. Taylor takes the place of

Arthur H. Halloran, Pacific Coast representative of the

McGraw-Hill Book Company, who has been secretary of the Pacific Coast Section, N. E. L. A., since the formation of that section. Mr. Halloran was forced to resign his position as secretary due to the increased necessity for more concentrated attention to the growing book sales of the company and production of new books.

C. F. Henderson has recently been appointed California agent for the Automatic Reclosing Circuit Breaker Company of Columbus, Ohio.

C. P. Bowie, petroleum engineer, U. S. Bureau of Mines, has returned to San Francisco from a trip through the southern California oil fields.

E. A. Wagner, engineer for the transformer department in the Fort Wayne works of the General Electric Company, is a recent visitor in Los Angeles.

T. E. Swigart, petroleum technologist, of the Bartlesville station of the U. S. Bureau of Mines, spent two weeks during June at the San Francisco office of the Bureau.

G. E. Armstrong, associate editor of the Journal of Electricity has left for New York where he will spend several weeks in the New York offices of the McGraw-Hill Company.

David Perry, formerly specialty salesman for the E. M. M. Service Company in Lindsay, has joined the organization of the Southern California Electric Company in Los Angeles.

G. R. Kenny, formerly rate research engineer with the San Joaquin Light & Power Corporation, Fresno, Cal., has resigned to accept a position with Stone and Webster in their Boston office.

C. A. Copeland, chairman of the Los Angeles chapter of the American Institute of Electrical Engineers, is making an extensive eastern trip which includes the national convention of the Institute.

A. S. Tyler, one of the pioneer contractors in Los Angeles, has opened a new store on Sixth Street near Western Avenue, where he will conduct a general contracting and merchandising business.

F. W. Smith, vice-president, United Electric Light and Power Company, New York, has just returned from Honolulu with Mrs. Smith. After a short visit in San Francisco they proceeded to New York.

M. J. Gavin, refinery engineer of the U. S. Bureau of Mines with headquarters at the Salt Lake station, visited the San Francisco office of the Bureau during June in connection with oil shale development.

A. H. Nicoll, telephone sales department, Western Electric Company, has returned to the San Francisco office of that company after an absence of seven years. During this time

Mr. Nicoll was with the company in Salt Lake City in charge of the motor specialty sales and the power appliance department.

J. C. Marshall, assistant secretary of the California Association of Electrical Contractors and Dealers, has arrived in Los Angeles where he will be permanently located in the interests of the southern members of the association.

K. E. Van Kuran, **John Jones** and **Harry Fenton**, from the Los Angeles office of the Westinghouse Electric and Manufacturing Company, are making a trip through Arizona and New Mexico looking after Westinghouse interests.

G. A. Frogner, formerly with the Emergency Fleet Corporation, has accepted a position with the Crown Willamette Paper Company, to take charge of the installation of a new paper machine in the Oregon City mill of this company.

J. P. Jollyman, engineer of electrical construction of the Pacific Gas & Electric Company, San Francisco, left for the East July 8, where he will visit the factories of the principal manufacturers of electrical apparatus, returning within six weeks.

G. W. Bernhard has been appointed manager of the Northwestern Division of the Great Western Power Company of California, with headquarters at Napa. This division includes the towns of Santa Rosa, Petaluma and Napa and the surrounding country.

A. S. Moody, assistant manager of the Northwest District of the General Electric Company, has been visiting the various factories of his company in the East, having attended the various electrical conventions in California en route to his office in Portland.

C. H. Lee, president of the California State Water Commission, has commenced an investigation of the encroachment of salt water from the bay into the lower delta region, in cooperation with the State Engineering Department. This encroachment has had an effect not only upon agriculture but also in introducing the teredo, which is proving very destructive in piles, in some instances used for foundation work in power plants built along the Sacramento River.

Lloyd Henley, assistant electrical engineer, California Railroad Commission, has been appointed Valuation Engineer

for the San Joaquin Light and Power Corporation as well as chairman of the committee on rules for overhead line construction in the state of California. This committee is to revise general order number 26 of the Railroad Commission and to incorporate in the revised order the requirements of chapter 499, statutes of 1911, as amended in chapter 600, statutes of 1915, thus placing all allied requirements under one cover.

The committee is now working on the proposed order and will soon call a meeting of all interested parties to discuss the first draft of it. Mr. Henley graduated from Stanford University with the class of 1908 and entered the construction department of the Pacific Gas & Electric Company where he worked for two years, leaving the company to work for J. G. White and Company as electrical engineer in charge of the construction of the Bakersfield steam plant of the San Joaquin Light & Power Corporation. On the completion of this work Mr. Henley joined the Pacific Gas & Electric Company as engineer in charge of construction of Drum Power House and upon completion of the plant remained there as foreman until 1918, when he joined the Railroad Commission as assistant electrical engineer.



William M. Rosborough, until recently in the National Lamp Works at Nela Park, has been transferred to the Coast where he has assumed the duties of assistant to J. A. Vandegrift, Pacific Coast manager of the National Lamp Company. Mr. Rosborough has been with the company since 1910, first in the engineering department at Cleveland and then in Atlanta where he was the southern manager of the Selby lamp division. After that he served two years in the army as first lieutenant in the tank corps and upon his return

was placed in charge of the manufacture and sale of foot-candle meters. He has been quite active in the work of the Illuminating Engineering Society.

M. O. Troy, manager of the transformer department of the General Electric Company's factory at Pittsburgh, recently spent a few days in Portland. Mr. Troy met some of the local engineers and discussed with them some of the new departures in transformer design.

S. J. Butts, president of the Los Angeles Association of Electrical Contractors and Dealers, is extremely proud of the high percentage of attendance from the South at the recent convention at San Jose. Fifty per cent of the membership from Los Angeles took the journey northward.

F. J. Airey, manager of the Los Angeles office of the Pacific States Electric Company, is making a six weeks trip in the East, visiting the various factories for which his company are distributors. He will also attend the General Electric Company's conference at Association Island.

D. H. Braymer, managing editor of Electrical World, who has been visiting on the Coast for some time, and **Robert Sibley**, editor of the Journal of Electricity, are taking a trip through the Northwest and Mountain states to observe the outlook for the expansion of the electrical industry.

E. W. Moreland, formerly with the Portland Railway, Light & Power Company, as efficiency engineer, has gone to Montreal to work with J. P. Newell on some appraisal work for the Canadian Government. Mr. Moreland will be engaged in these duties for some time, after which he will return to Portland.

S. J. Reno, sales manager for the Illinois Wire and Cable Company of Sycamore, Ill., was a recent visitor in Los Angeles on his return trip from Portland, where he attended the Shriners' convention. Mr. Reno states that his company is now doubling the capacity of its factory to care for increasing business.

R. E. Frickey, formerly electrical engineer for the Northern California Power Company, who, during the war period was engaged in electric welding at Hog Island, and later in electric welding at Philadelphia, is again located in San Francisco. Mr. Frickey expects to specialize in welding problems with headquarters in San Francisco.

C. E. Johnson, general manager of the U. S. Electrical Manufacturing Company of Los Angeles, has just returned from a tour through various eastern centers including Pittsburgh, New York, Boston, Schenectady, Detroit, Chicago and Milwaukee, where he has been studying the general business and financial conditions of these manufacturing centers.

P. B. McKee, vice-president and general manager of the California-Oregon Power Company, has become associated with Paul R. Parker and Donald McKee in the California Engineering Co. Mr. Paul McKee will still retain his position with the California-Oregon Power Company. Mr. Parker was manager of the ship yard at Benicia during the war and Mr. Donald McKee served in the Navy, receiving a commission as

ensign. Mr. McKee is at present making a ten day trip over the California-Oregon Company's system.

F. O. Aspinwall, representing the Committee on Inflammable Liquids of the National Fire Protection Association, also connected with the Associated Factory Mutual Fire Insurance Company of Boston, Massachusetts, has been in California for several months making an exhaustive study of fire hazards in that state, also of the methods being used in California of extinguishing and preventing oil and gas fires.

Harris J. Ryan, of the electrical engineering department of Stanford University, has been elected to the National Academy of Sciences. This honor is accorded Professor Ryan in connection with his valuable work concerning high tension voltage. Two other Stanford professors have also been elected to the Academy: **Hans F. Blichfeldt**, professor of the mathematics department, for his contribution to the knowledge of pure mathematics, and **Bailey Willis**, professor of the department of geology, for distinguished work in the field of geology.

L. H. Newbert, president of the Pacific Coast Section of the National Electric Light Association, has appointed the following chairmen of the various committees for the coming year: **R. A. Balzari** of the Westinghouse Electric and Manufacturing Company, chairman of the Membership Committee; **J. A. Britton**, vice-president and general manager of the Pacific Gas & Electric Company, chairman of the Public Policy Committee; **P. R. Ferguson**, auditor, Southern Sierras Power Company, chairman Accounting Committee; **R. E. Fisher**, assistant manager commercial department, Pacific Gas & Electric Company, chairman of the Commercial Committee; **L. M. Klauber**, assistant general superintendent of the San Diego Consolidated Gas and Electric Company, chairman of the Engineering Committee, and **Robert Sibley**, editor of the Journal of Electricity, chairman of the Publicity Committee.

E. E. Stark, one of the pioneers of electrical development on the Pacific Coast has just returned from New Zealand having been away from the United States for seventeen years. When in San Francisco prior to 1903 Mr. Stark was connected with the SKC system, while in New Zealand he had charge of a number of municipal plants.

Miles Steel, Pacific Coast representative of the Benjamin Electric Manufacturing Company, as announced in the Journal of Electricity April 15, 1920, has moved to new quarters. Mr. Steel has decided, however, to make the move complete and has lately taken unto himself a wife, formerly Miss Farrar Kennett of Butte, Montana. Mr. Steel has long since been given over as a hopeless bachelor, and now the news of his marriage comes as a very pleasing surprise to the members of the trade in the West. It looks as if this

new start in the year 1920 augurs much for Mr. Steel, in happiness to himself personally and in helpfulness to the industry generally, which he has so faithfully served in past years.

OBITUARY

General William Crawford Gorgas, surgeon-general, U. S. A., died in London July 3 after a brief illness. General Gorgas will go down in history as the one man who did more for the advancement of the Central American States than any other, due to his work in sanitation in the Panama Canal district. Born in 1854 in the South, where he received his education, he early entered the army in the medical branch and continued to rise until he held the highest rank possible.

Meeting Notices for Electrical Men

(A presidential candidate spoke at one of the two meetings of the San Francisco Electrical Development League reported here, and a Ladies Day excursion to the Electrical Home was the special feature of the other. The annual dinner meeting of the Portland Sections of the N. E. L. A. and A. I. E. E. is reported along with the annual convention of the Telluride Association and the formation of a new chapter of the Society of Illuminating Engineers.—The Editor.)

The San Francisco Electrical Development League

Senator Owen of Oklahoma was the speaker of the day at a recent meeting of the San Francisco Electrical Development League. Previous to Senator Owen's speech, Mr. Henry Bostwick, district manager of the Pacific Gas & Electric Company, stated that the committee which had been appointed to investigate the feasibility of an electrical show for this year desired to report that it did not seem propitious at this time to hold a show. W. S. Berry asked that this report be held on the table until the jobbers had held a meeting and had taken some action. He stated that the majority of the jobbers believe that such a show should be held and the report of the committee was ordered held over.

Albert Elliot, "the electrical lawyer," was chairman of the day, and in introducing Senator Owen told of the active part the Senator had played in the passage of the Water Power Bill, and introduced him as the "father of the Federal Reserve Act."

In opening his speech, Senator Owen traced the history of the Republican party and stated that although he was a good Democrat he had always had a lot of respect for some of the Republican acts that had been started in the West. The Senator then stated that there is no apparent cause for a financial crisis at this time, that there are high wages, a shortage of labor, and that everybody is vigorously employed in productive processes and consequently the country should be in a prosperous condition. The criticisms of the Federal Reserve Board in raising the rate of interest so that there was no credit left for productive industries was denounced in no uncertain terms by Senator Owen, who proceeded to explain in detail the workings of the Federal Reserve banks throughout this country during the past year. The effect of this upon the electrical industry was shown by the Senator in that the raising of rates by the Federal Reserve Bank had made the savings banks charge ten per cent for money, which had made business men hesitate to go into productive business that involved a large expenditure of money. It was pointed out that there is the greatest need for United States products in Europe and need of United States food, raw material and machinery, to put Europe into a state of self-support. This condition will mean many years of big production for the United States, and the Senator urged in closing the development of water power of the West, as in this way the natural resources of the country will be made to serve the best interests of the people.

Portland Sections, A. I. E. E. and N. E. L. A.

The annual dinner meeting of the Portland Sections of the A. I. E. E. and N. E. L. A. was held at the University Club Tuesday evening, June eighth.

After the dinner acting chairman Heston announced the Pacific Coast Convention of the Institute to be held in Portland in July, discussing the program in detail. Brief verbal reports of the Pasadena convention were given by W. M. Hamilton and O. B. Coldwell.

The speaker of the evening was Mr. Edward L. Wells, meteorologist in charge of the Portland station. Mr. Wells went into the theory of meteorology and explained the formation of hail, sleet and snow, as well as the causes of storms of various kinds.

He spoke of some experimental work which he conducted while in charge of a station in Idaho, but which was never completed, and in which measurements of snow fall, moisture content and precipitation were made on watersheds and expressed it as his opinion that if comprehensive data of this kind were compiled over a period of years it would be of much value to utilities operating hydroelectric plants.

The results of the election of officers of the Portland sections of A. I. E. E. and N. E. L. A. for the ensuing year were announced, as follows:

A. I. E. E.

Chairman, W. D. Scott; secretary, W. C. Heston; executive committee, C. P. Osborne and O. L. LeFever.

N. E. L. A.

Chairman, A. D. Leach; vice-chairman, J. D. Scott; secretary, Geo. L. Meyers; treasurer, R. J. Davidson; executive committee, C. P. Osborne, A. S. Moody, C. L. Wernicke.

Synchronous Club Meeting

At the regular June meeting of the Synchronous Club of Los Angeles the subject of discussion was "Power Factor" and the principal address was given by W. L. Boxall, power contract agent of the Southern California Edison Company. Mr. Boxall urged cooperation between motor dealers and the central station in order that the best motor might be secured for the load. He went on to say that induction motors should be selected with the idea of being loaded close to their rating and that synchronous machines are recommended for many purposes, principally for motion picture production, so that the power factor may be improved and a greater amount of load carried by the existing generating and distributing equipment.

An enjoyable entertainment feature was the production of a one-act play, "Souvenir Spoons," which was presented by the Wallis Players Dramatic Club. An electrically cooked dinner preceded the meeting.

BUILDERS OF THE WEST — LXXXI



J. D. ROSS

In handling the municipal distribution of hydroelectric energy for illumination and industrial uses the West has unusual achievements to its credit along the lines of installation, operation and delivery. To J. D. Ross, Superintendent of Distribution for the City of Seattle, this issue of the Journal of Electricity is affectionately dedicated in appreciation of his contributions to the West in new ideals of management and in successful engineering installations for municipal distribution.

San Francisco A. I. E. E. Officers Elected

At the annual election of executive committee officers held by the San Francisco section of the American Institute of Electrical Engineers the following were elected: For two-year term, J. T. Ryan and J. P. Jollyman. For one-year term, A. J. Reed. The section chairman and other officers will be selected from among themselves by the executive committee.

Illuminating Engineering Society Chapter Formed

Following the action taken recently by a small group of members of the Illuminating Engineering Society who reside in the San Francisco Bay district, a petition was made to the Council of the Society to grant a Chapter charter for that section. This petition has been acted on by the Council and the charter granted, which makes the San Francisco chapter the first to be formed in the Society, all the other branch organizations being sections.

Upon receipt of the advice that the chapter had been granted a meeting was held in San Francisco on June 29, at which time the following officers were elected to hold office until the first of October, which is the beginning of the Society year: chairman, L. E. Voyer; treasurer, J. A. Vandergrift; secretary, H. H. Millar; board of managers, Miles Steel, W. Hanscombe, Romaine Myers, R. L. Prussia and W. P. Lowe.

To date, over 50 applications for membership in the Society have been received from engineers resident in the Bay district.

Ladies' Day, San Francisco Electrical Development League

The last meeting of the San Francisco Electrical Development League before the summer vacation was held on June 28th at the Palace Hotel in San Francisco. Following the usual custom, this was Ladies' Day, and the chairman of the day was Robert Sibley, editor of the Journal of Electricity and Pacific Coast Editor of the Electrical World and Electrical Merchandising.

During the course of the luncheon several songs were given by Lowell Redfield's quartet, and Albert Elliot presented a set of books to Arthur Halloran of the McGraw-Hill Book Company in recognition of the service he had rendered while secretary of the Pacific Coast Section of the N. E. L. A. Accepting this gift, Mr. Halloran stated that the set would be a memento of a pleasurable service and he expressed his heartfelt thanks to the individuals who had contributed toward it. Mr. Sibley then introduced Mr. D. H. Braymer, managing editor of the Electrical World, who stated that although this was his first visit to the West, yet he was not entirely a stranger to the wonders of the country west of the Rocky Mountains as he had been taking a correspondence course in this from Bob Sibley for the past six months. Mr. Sibley then introduced James H. McGraw, president of the McGraw-Hill Company, as the greatest publisher of engineering magazines in the world. Mr. McGraw spoke of the wonderful advance of the electrical industry on this coast, and the vast possibilities released through the passage of the Water Power Bill, and stated that the Electrical Trio, Electrical World, Electrical Merchandising and the Journal of Electricity, were there for the purpose of giving service to the men of the electrical industry, and that he felt great credit was due to Mr. Sibley for the manner in which he has upheld the West and brought it to the attention of the electrical engineers of the East. Mr. Sibley then introduced the speaker of the day, Judge William H. Waste of the Appellate Court, by stating that the spirit of the West had been exemplified in the Mission Play and that the Missions of California are the most picturesque traditions that have been handed down to us. Judge Waste traced the history of the west coast of America from the earliest discoveries, and cited those events which led up to the determination of the Spanish to conquer Alta California. He told of the expelling of the Jesuits and the sub-

sequent appointment of Franciscan fathers who took charge of the Missions under Father Junipero Serra. Then followed a series of beautiful slides showing all of the existing Missions and sketches of those that have been destroyed.

Following the meeting, the ladies were taken out to the Electrical Home in St. Francis Wood where a special demonstration of the features of the home were given for their benefit.

Portland Contractor-Dealers

The regular meeting of the first district, Oregon Association of Electrical Contractors and Dealers, was held Monday, June 28, at the Chamber of Commerce.

The secretary read a report from G. R. Cooley, contractor-dealer of Seattle, on his trip to the N. E. L. A. convention at Pasadena, which was very interesting and caused considerable discussion.

Mr. Knight reported for the membership committee that, due to the demands made on his time on account of the Shriners' and other conventions, no progress had been made by his committee since last meeting. The secretary recommended that each member of the association constitute himself a member of the membership committee and assist Mr. Knight in his work.

The secretary recommended that the present system of trying to solve mutual problems of the contractor-dealer and jobber through the efforts of a large committee be discontinued, and that most apparent difficulties could be overcome by the contractor-dealer taking matters up individually with the respective jobbers, but that all matters of broad policy affecting the dealings between contractor-dealer and jobber be brought up and discussed at open meetings of the association. A motion to follow this plan was made and carried.

Acting chairman Sroufe, in discussing the relations between the jobber and members of the association, urged that the jobbers make it a point to have representatives at all meetings of the association in order that mutual problems may be fully and intelligently discussed.

The secretary reported that there was a movement on foot to start an electrical table for noon luncheons with the idea of bring all interested in the electrical industry in this district into closer touch with the purpose of getting better acquainted and thereby paving the way towards closer harmony in the industry.

The attendance was as follows:

Beaver Electric Co., Jaggard-Sroufe Co., E. L. Knight Co., R. N. Lewis, L. M. Olsiver, W. C. Heston, Fred Todd, Pierce-Tomlinson Co., R. R. Poppleton, Scott Electric Co., Vanderlip & Lord, Western Electric Works, C. M. Will.

Architects Enjoy Electrically Cooked Dinner

On the evening of June 24th, two hundred members of the Southern California Chapter of the American Institute of Architects attended a dinner given by the manufacturers who maintain exhibits in the Metropolitan Building in Los Angeles.

There were the customary papers and discussions, but the interest of the meeting centered in a turkey dinner prepared and served by E. C. Ebert, local Simplex representative.

After dinner the architects visited Mr. Ebert's display room where the dinner was prepared, and were very much surprised that so many could have been served with so little equipment. Everything except the string beans was cooked in the Simplex oven, the beans being prepared on the surface burner. The punch, salad, and ice cream were kept in an electrically operated refrigerator, and to make the job complete the dishes were washed in water from electric heaters.

Convention of Telluride Association

The annual convention of the Telluride Association, an organization which has for its purpose the education of young men along electrical lines, was recently held in Provo, Utah. A feature of the session was the presence of a large number

of the older members and alumnae, many of whom had served in the army and navy and were not discharged in time to attend the convention last year.

In addition to reviewing the work of the past year and making provision for the continuation of the various interests of the organization, the convention granted about twenty scholarships to Cornell University, where the association conducts its own house, and also granted a number of scholar-

ships to other schools and universities. Provision was made for further development of Deep Springs ranch, California, where some of the applicants are trained for membership in the organization.

The officers elected for the ensuing year are:

William Dwight Whitney of New Haven, Conn., president; Earl C. Bonnett of Provo, Utah, vice-president; J. A. Boashard of Provo, secretary. The other officers are: F. C. Noon of Los Angeles, California, chancellor; E. A. Thornhill of Boise, Idaho, dean, and W. L. Biersach of Provo, manager and treasurer.

HAPPENINGS IN THE INDUSTRY

COMMENTS ON WATER POWER LEGISLATION

Now that President Wilson has signed the Water Power Bill, the comments on the situation by other technical journals are of interest. The following are extracts from editorials in Engineering News-Record, Electrical World, and Electric Railway Journal. The former notes that:

"In spite of the fact that Engineering News-Record is decidedly in favor of the bill, it has serious doubts of the validity of the signature which the President affixed to it some time before June 12, as announced at the White House on June 18. The whole issue hinges on an interpretation of the Constitution. The ten day limit on the Water Power Bill (as understood to be the meaning of Sec. 7, paragraph 2 of the Constitution) expired June 12. No notice of any action came from the White House until June 18 when it was announced that the President had signed the bill 'within the ten day period, of course.' Here is where the weakness of the Attorney-General's decision appears. If the President can wait one week before announcing the past signing of the bill, what is to prevent him waiting two months or two years?

"Engineering News-Record wants to see water-power development go forward. There never was a time when quick and decisive action was needed more imperatively. It therefore hopes that the constitutionality of the law's enactment will be decided at once so that all doubt of proceeding under it will be settled."

The Electrical World thinks that "the country is to be congratulated on the final enactment of the bill" which in its various forms has been before Congress for the last eight years, but expresses the opinion that the vicissitudes of the bill are a striking example of legislative inefficiency due to the shifting pressure of warring factions and clashing interests. The Electrical World notes that:

"Opposition was due to various forces, some of them raising debatable questions as to the rights of the states, others based on socialistic propaganda, and still others having their origin in the bogie of a water-power trust. As we have repeatedly pointed out, there is not, and never was, any such thing as a water-power trust, but only a growing recognition on the part of banking interests of the value of hydroelectric development as an investment looking to the future of American industries. Certainly the government will have it fully within its power through its commission to see to it that no menace to the public shall spring from this appreciation of values. In the actual working out of water-power development under this act the Federal Power Commission has almost plenary authority. It is composed of the Secretaries of War, of the Interior and of Agriculture, the three departments whose activities are most closely touched by the law. As a working body the efficiency of the commission will largely depend on the executive secretary and his staff, operating under the guidance of the Cabinet members named. It is just here that we hope the government will give the commission a very free hand to secure the best expert advice obtainable, for on this will hinge the ultimate success of the movement.

"At this time, when the fuel situation is monthly growing more acute, especially from difficulties of transportation, the help available from water powers is of vital importance, and the government cannot act too quickly in organizing the commission and laying the groundwork of something more than a local and limited system of distribution. The time has come for working on a large scale with a broad view of the industrial needs of the country. Our most earnest congratu-

lations to the wise and far-sighted legislators who have seen the needs of the country and joined in putting through what promises to be one of the greatest constructive projects of the nation's history."

Electric Railway Journal also has some doubts as to the legality of the signature of the President but hopes that the bill is now a law in fact. They believe:

"The bill will provide a long-sought-for opportunity to develop economical power for our electric railways and industries. This legislation has had twelve years of rocky travel and there have been legitimate differences of opinion as to some provisions, but the result is that now the bill provides a basis upon which water power development may now begin.

"Most important, the bill gives recognition to the principle that the integrity of the legitimate investment in a utility of public service, such as water power development is, will not be impaired if the public decides to take over the business. At the same time, by the fifty year lease provision, the public is protected in case of future changed conditions.

"This legislation should encourage and invite capital which is seeking an investment field rather than a speculation. The result will be a hydroelectric power business, on a sound basis, which will be a factor in the electrification of trunk lines, in economical power production for existing railways and industries and in coal (and oil) conservation."

P. G. AND E. CO. AND GREAT WESTERN POWER CO. GRANTED RATE INCREASES

The Pacific Gas and Electric Company and the Great Western Power Company have been authorized by the Railroad Commission to increase their rates for electricity by the addition of a 10% emergency surcharge to apply on all bills rendered beginning with July 10, 1920, and ending with April 10, 1921, a period of nine months. The Commission's decision adds to the standard rate schedules of both companies the surcharges that have been allowed on previous applications, the emergency percentage increase granted being imposed on the combined rates. The effect will be a fifteen per cent increase over the amounts that have been collected in recent months. In the case of the Pacific Gas and Electric Company it is estimated that the new emergency rate will produce additional revenue of \$2,200,000 for the year ending July 1, 1921.

Shortage of water power and the consequent necessity for the production of a large quantity of electricity by steam (using fuel oil costing \$1.81 a barrel) and increases in wages are responsible for the surcharge. The period of nine months for the collection of the surcharge is fixed by the Commission in the belief that by next April sufficient new hydroelectric power will have been installed to considerably reduce the production of expensive steam power.

The increase in rates applies to all territory served by the Pacific Gas and Electric Company, including that operated under lease from the Sierra and San Francisco Power Company, and the territory recently acquired through the purchase of the properties of the Northern California Power Company. In the case of the Great Western Power Company the Commission directs that company to bring to the level of

its other rates its charges for municipal street lighting, street railway power and power sold to other public utilities, which three classes of service were exempted when surcharges were originally fixed in July, 1918.

The following, from the opinion in the Pacific Gas and Electric Company's case, is a summary of the Commission's estimates of the company's revenue and expense for the twelve months commencing April 1, 1920:

Gross revenue	\$19,320,300
Inter-department revenue	322,200
Total revenue	\$19,642,500
Maintenance and expenses	2,040,000
Operating expense	3,150,000
Fuel oil	4,866,000
Purchased power	580,000
General expense	598,000
Uncollectible bills	55,000
Insurance reserve	80,000
Taxes	1,200,000
Depreciation	1,450,000
Total expense	\$14,019,000

The Commission's engineers estimated that the Pacific Gas and Electric Company's output for the year 1920 would total 1,430,000,000 kw-hr. as against the company's estimate of 1,411,514,990. The Commission's estimate on purchased power is 110,000,000 kw-hr.; the company's, 104,700,000. In its estimate of power to be produced by steam the company claimed 610,900,000 kw-hr. The evidence showed a production of 570,000,000. Hydroelectric power aggregating 750,000,000 kw-hr. will be produced, according to the Commission's estimate. The company figured on 695,911,664.

The company's claim for maintenance totaled, including wage increase of April 1, 1920, \$2,052,908. The Commission's allowance is \$2,040,000. The company's oil estimate of \$5,127,050 is reduced to \$4,866,000 by the Commission. The allowance of \$3,150,000 for operating expense for 12 months includes \$275,000 for salaries and wages, an increase effective April 1st. The company estimated \$3,174,627.

In a further discussion of the Pacific Gas and Electric Company's case Commissioner Devlin made following remark:

The nature of the proceeding upon which the present order is based is such that detailed analysis * * * cannot, by reason of the emergency character of this part of the proceeding, be made. Such analysis will be postponed for further hearing.

No prejudice will be suffered if increases do not result in an unreasonable return. Sufficient analysis has been made to determine that no injustice is done the consumers. The company's property should be maintained in first-class condition. It would be false economy to reduce maintenance at this time. It would result only in decreasing the quality of service in the future.

The following is from the decision in the case:

Money invested during the last two years has cost considerably more than previously. Certain securities cost approximately 6 to 6½ per cent prior to the war. The financing during the past year and a half has been at a rate of between 7 and 9 per cent and the money which has been borrowed to carry on the developments the company is now commencing is costing 8.88 per cent.

On July third the following editorial on this rate increase appeared in the San Francisco Chronicle:

RATES FOR UTILITY SERVICE

The Railroad Commission has authorized an increase of 15 per cent on the rates for electric current to be charged by the Pacific Gas and Electric Company and Great Western Power Company, the surcharge to continue until April 10, 1921. That is in accordance with the policy of the Commission not at this time to authorize permanent increases in rates charged by public utilities, but to grant aid in the form of surcharges to continue for a limited period "until the clouds roll by."

They are necessary. We need the development of water for the creation of power, the irrigation of land and for industry and domestic use. We need from the public utilities the best service which can be given and, within reason, the reliability and quality of service is paramount to the question of cost.

We shall not get any of these things except by the very large and for many years the constant increase of capital investment. We shall not get this investment except by reasonable assurance to capital of reasonable return on that investment or by extorting it from the taxpayers, with the reasonable assurance that there will be no return.

The people of the country prefer to attract private capital to these services by the reasonable assurance of reasonable return. Those who imagine that they do not pay any taxes might not be concerned as to where the money comes from except that they are the most insistent of all for a high quality of service, which they will not get from any government.

So long as rates for public service are fixed by representatives of customers the public is certainly in no danger of extortionate rates. All but the reds are willing to pay fair rates.

Consequently enlightened public sentiment will favor the granting by rate fixing bodies of whatever rates are necessary to pay for the service demanded.

ELECTRICAL DEVELOPMENT LEAGUE'S HETCH-HETCHY TRIP

The itinerary for the excursion of the Electric Development League to Hetch-Hetchy is as follows:

Friday, July 16th—
8:00 p.m. Leave San Francisco—Santa Fe Train No. 2—in special Pullman cars.

Saturday, July 17th—
12:18 a.m. Arrive Riverbank.—Thence to Hetch-Hetchy Junction via Sierra Railway as a special train.
8:00 a.m.—Arrive Rattlesnake Creek and Priest Portal.—Inspect Aqueduct Tunnel construction and Priest regulating reservoir site.
10:15 a.m. Arrive Big Creek Camp.—Shaft to Aqueduct Tunnel, 566 ft. below surface, two tunnel headings.
4:15 p.m. Arrive Hetch-Hetchy Valley, Damsite Camp.—Inspect main storage dam construction (Utah Construction Company).

Sunday, July 18th—
8:00 a.m. Leave Damsite.—To Early Intake Camp via tramway.—Inspect Early Intake Power House.—Power House Aqueduct and forebay flume.—Inspect tunnel.—To Intake Siding via tramway.—Visit South Fork Portal of Aqueduct tunnel.
4:45 p.m. Arrive Groveland.—Headquarters Building, Railroad Shops, Warehouse, Hospital, Employees' Club House.
7:00 p.m. Leave Groveland.

Monday, July 19th—
7:30 a.m. Arrive Ferry Building, San Francisco, via Santa Fe Train No. 11.

INDUSTRIAL CONSTRUCTION IN THE NORTHWEST

The Crystal Ice & Cold Storage Company is erecting a new 5-story concrete building on the quarter block adjoining their present plant in Portland, Oregon. This will be the most modern ice cream factory on the Pacific Coast. The plant will be electrically operated throughout—special lighting arrangements and ice cream hardening rooms with a capacity of 40,000 gal. per 24 hours are some of the features of the plant. These hardening rooms will be lined on all sides with pure cork 8 inches in thickness. The total installed motor capacity will be 230 hp., individual drive being used almost exclusively.

The Oregon Pulp & Paper Company are constructing a paper mill at Salem, Oregon, for the manufacture of tissue and high quality glazed book paper out of wood pulp. The Portland Railway, Light & Power Company have entered into a contract with the paper company to supply them with 1500 kw. of electric power at a potential of 60,000 volts. The daily output of the mill will have a value of \$5,000.

CALIFORNIA-OREGON POWER COMPANY APPLIES FOR RATE READJUSTMENT

The California-Oregon Power Company has applied to the Railroad Commission for an order readjusting its rates and charges for electric energy and for a modification of certain contracts under which it has been delivering electric power to three irrigation projects in Siskiyou county. The holders of the contracts are the Shasta River Water Association, the Big Springs Water Company and the Lucerne Water Company. The last named company is paying three-fourths of a cent per kw-hr. for its energy. The other companies are getting power upon a flat rate basis of \$2.50 per acre per year. The flat rate contracts have been in existence since 1913 and the Lucerne contract since 1916.

The power company asks that the contracts be modified or canceled, charging that the water companies have indulged in practices conducive to an uneconomical use of both electric energy and water. It is claimed that there has been, on the part of the water companies, a violation of the terms of the contracts governing the use of electric energy.

The company asks for a final readjustment of its rates on the ground that it is now in a position to determine the effect upon its revenue of the rates fixed by the Commission on a previous application. In its former decision the Commission ordered the company to install meters with the result that today more than ninety per cent of its consumers are being served on a meter basis, a fact set up by the company in its request for a final readjustment of rates. It is further claimed by the company that it has in prospect "the reorganization of its financial structure with the view to enabling it more readily to obtain the necessary funds for the construc-

tion of new power plants or increasing the capacity of existing plants, and making extensions and enlargements of its system for the logical and proper development of its territory." Continuing the company says:

"The applicant believes that with the readjustment of its rates and charges so as to enable it to earn an adequate return for the services now being rendered and the consummation of the reorganization plan, it will be able to provide securities that will permit it to obtain the necessary funds for attaining the larger ends."

It is claimed that the value of its California holdings, for rate making purposes, is \$4,377,079. The value of the Oregon properties is given as \$2,814,744.26.

POWER RATES CUT BY STATE BOARD

Two rulings of unusual importance have been filed by the Public Service Commission of Washington. In one of these the commission reduces the earnings of the Puget Sound International Railway & Power Company on its Everett business from 43.60 per cent upon electric power current, and from 11.61 per cent upon light current to 8 per cent upon the valuation of each.

In its second order the commission directs the North Coast Power Company to repay the city of Centralia the full amount of rate increase collected by the company from the city prior to July 1, 1920, collection of which increase was commenced by the company on December 20, 1919, on wholesale rates for current supplied the city lighting plant. The increase ordered repaid amounts to about \$800 for each of the seven months covered by the order of the commission. The increased rate, however, becomes effective July 1, as previously allowed.

In the Puget Sound International Railway & Power Company order, affecting Everett rates, the commission accepts the company's challenge of state jurisdiction for regulatory purposes over electric energy sold for power. In doing this the commission undertakes to separate and value for rate making purposes, current sold for lighting and that for power. It is considered certain that this ruling will be contested in the Supreme Court on a former Supreme Court decision in what is known as the Inland case from Spokane, wherein the court held in effect that sale of surplus or "dump" power should not be considered a public use, subject to commission regulation, but a use subject to any disposition the company might be able to make of it.

In the Everett ruling the commission concludes that the Supreme Court in the Inland case did not intend to exclude from commission regulation different conditions such as it finds exist at Everett in the sale of power current as an established business.

In finding the Everett rates unreasonable and more than sufficient the commission directs the company to file within ten days a reduced schedule of rates applying to all light and power service which will yield the company an annual net return of 8 per cent upon the valuation fixed by the commission for the light and power systems singly and combined as of December 31, 1918, with net additions and betterments to June 1, 1920.

The company is also directed to file with the commission copies of all contracts with light and power users that are in conflict with the new schedule of rates, and the city of Everett is similarly directed to file certified copies of its franchises and contracts with the company.

The North Coast Power Company sells light current to the system owned by the city of Centralia. On the company's complaint in 1919 the commission made a valuation of the Centralia business of the company, found that the company had been losing 3.40 per cent annually under the old contract rates and allowed as a fair and reasonable return increased rates bringing the annual earnings up to 1.97 per cent on the investment.

In reopening the rate upon application of the city of Centralia and finding the company to have exceeded its au-

thority in collecting the new rate without formal cancellation of the previous contract by regular order, the commission lays down the rule that affirmative action by the commission must be taken before such contracts can be legally voided.

MECHANICAL ENGINEERS DISCUSS CODE OF ETHICS

A proposed new Code of Ethics, prepared by a committee of Mechanical Engineers, but intended to serve as a basis for a code of principles for all engineers, was discussed at the semi-annual meeting of the American Society of Mechanical Engineers, held in St. Louis recently.

The essential feature of the Code is its brevity—it contains but fourteen short paragraphs. The Code is intended to be a brief, positive statement of the professional relations of engineers to the public, to their clients or employers, and to one another.

The committee formulating the Code recommended the establishment of a Standing Committee on Professional Conduct to interpret it, and also to judge cases of questionable ethical conduct on the part of engineers. The personnel of the committee was as follows: A. G. Christie, chairman, Robert Sibley, John V. Martenis, H. J. Hinchey, Charles T. Main.

NEW ZEALAND HAS LARGE HYDROELECTRIC PROGRAM

Over thirty million dollars is to be expended by New Zealand for the development of hydroelectric power, the largest project being located at Arapuni, about 126 miles south of Auckland. Besides this project for which the government has appropriated \$21,899,250, there are a number of municipal and private hydroelectric projects in various stages of development throughout the dominion. A loan of \$7,300,000 has been authorized for the construction of a hydroelectric plant at the outlet of Lake Monowai and will supply current to Invercargill and the surrounding country.

The city council of Wanganui purposes to develop a hydroelectric power plant at the source of the Wangaehu River, about thirty miles from the town, and it is estimated that the cost will be \$1,216,625. The plant will develop 6,000 horsepower and will be submerged in the dam. This is the first plant of this kind to be installed in the British Empire.

VANCOUVER TO INSTALL STREET LIGHTING SYSTEM

A report on the cost of installing a permanent lighting system in Vancouver will be presented to the city council at its next regular meeting, at which time it is hoped to have enough property owners' signatures to a petition to insure the new system.

The lights are to be installed on an 8800-foot front in the business district, six to the block, with three to each side of the street. The estimated cost of the installation is \$26,400, including interest on bonds, or an annual cost of 30 cents per front foot. Costs are being compiled on cluster lights and a single light to each post.

PACIFIC GAS AND ELECTRIC COMPANY'S PETITION DENIED

The Pacific Gas and Electric Company will not be allowed to discontinue supplying water for power purposes to mines in Nevada county, the Railroad Commission having ordered a dismissal of the application. The application was opposed by Nevada City and Grass Valley, the Indian Springs and Wolf Creek Water Users' Association, New Blue Point Mining Company, Empire Mines and Investment Company and North Star Mines Company. In the opinion accompanying the order in the case the Commission says:

Deprivation of the water now supplied by the company to the mines and irrigators in Nevada county would be unwarranted and would result in very substantial and unjust prejudice to those water consumers, and there would be no sufficient corresponding or compensating benefit to the public in the increased production of electric energy.

AMERICAN DELEGATES ATTEND MEETING OF ADVISORY COMMITTEES IN BRUSSELS

Meetings of the Advisory Technical Committees of the International Electrotechnical Commission were held in Brussels during the past Spring months. The meetings were attended by delegates from eight national committees—Belgium, France, Great Britain, Holland, Italy, Spain, Switzerland, and the United States. There were about 40 delegates in all.

Although official decisions of the Commission are made only in plenary meetings, much of the work of the Commission is accomplished in the meetings of the Advisory Committees. Four of the Committees met at Brussels, namely: Rating, Definitions, Graphical Symbols, and Standard Voltages.

The meetings were attended by six American delegates: Messrs. C. O. Mailloux, C. E. Skinner, H. M. Hobart, A. H. Moore, L. W. Chubb, and P. G. Agnew. Dr Mailloux is president both of the International Electrotechnical Commission and of the United States National Committee.

Rating —

The Advisory Committee on Rating was presided over by Mr. Guido Semenza of Italy. The principal results of the meeting of this committee were the acceptance of:

1. The hot-spot principle as a basis of standardization.
2. The classification of insulating materials.
3. The classification of methods of measurement.

At the request of the American delegates the question of the terminal marking for transformers was deferred with the understanding that the American committee would submit a scheme sufficiently comprehensive to include all classes of apparatus and machinery.

Definitions —

This committee held joint sessions with the committee on Symbols, under the presidency of Professor Janet of France. Definitions of about 60 terms were approved. There was considerable discussion as to the advisability of attempting the preparation of a fairly complete International Electrotechnical vocabulary. Such vocabularies have been prepared by the national committees of France, Holland, and Italy. It was decided that these might serve as a basis of an international vocabulary, and a special committee was authorized for actively undertaking the work of its preparation.

Symbols —

The Italian graphical symbols which had been formally submitted by the Italian National Committee at a previous meeting, were taken as a basis for discussion. The comprehensive list prepared by the British Engineering Standards Association, and Mr. Cheney's paper in the Journal of the A. I. E. E. for February, 1920, which embodied the work of an A. I. E. E. sub-committee, were used as supplementary documents. Agreement was reached upon a list of about 100 symbols.

Standard Voltages —

Owing to variety of circumstances, a great many voltages are now used in Europe, and in the absence of standardization work, other voltages are being added. The European delegates felt strongly that immediate work should be done on two subjects—the standardization of voltages up to about 50,000, and the standardization of specifications for pin insulators. Some tentative proposals were formulated for the consideration of the various national committees. In informal conversations it was urged upon the American delegates that it would be very desirable for a comprehensive statement of American practice, accompanied by proposals, to be prepared and forwarded for the consideration of the other national committees.

MERGER OF COLORADO POWER COMPANIES

The Home Gas and Electric Company of Greeley, Colorado, is to purchase the Farmers Electric and Power Company of Eaton, exercising an option which it has held for the past six months. The Farmers Electric and Power Company serves all the territory from the north limit of Greeley to the town of Pierce, together with the territory surrounding Lucerne, Ault, Eaton and Pierce. The pumping plants of the Great Western Sugar Company which irrigate about 17,000 acres of land will be included in the purchase, as will the contracts now pending to supply the towns of Nunn and Pierce with electric current.

LOS ANGELES GAS & ELECTRIC CORPORATION

The Los Angeles Gas & Electric Corporation is to issue \$1,500,000 of bonds which are to be deposited as security for \$1,000,000 of four-year notes. The money is to be used to pay in part for permanent extensions, additions and betterments to the company's plant. The company estimates that its expenditures for construction work in 1920 will aggregate \$1,541,260.

NATIONAL COPPER PRODUCTION

The production, export and domestic consumption of copper is a matter of prime importance to public utility companies, as they are great users of copper and the cost of copper is of interest to them at all times.

Statistics recently compiled show that the copper mines in the United States produced about 5% less in November than in October. The lowered price of copper and the strikes were the chief causes of this decrease in output. Fifteen companies, which produced about 75% of the country's output, produced in October 85,263,370 lb., and in November 81,198,170 lb.

The reasons for the decreased production are clear to anyone who has followed the situation in the industry and

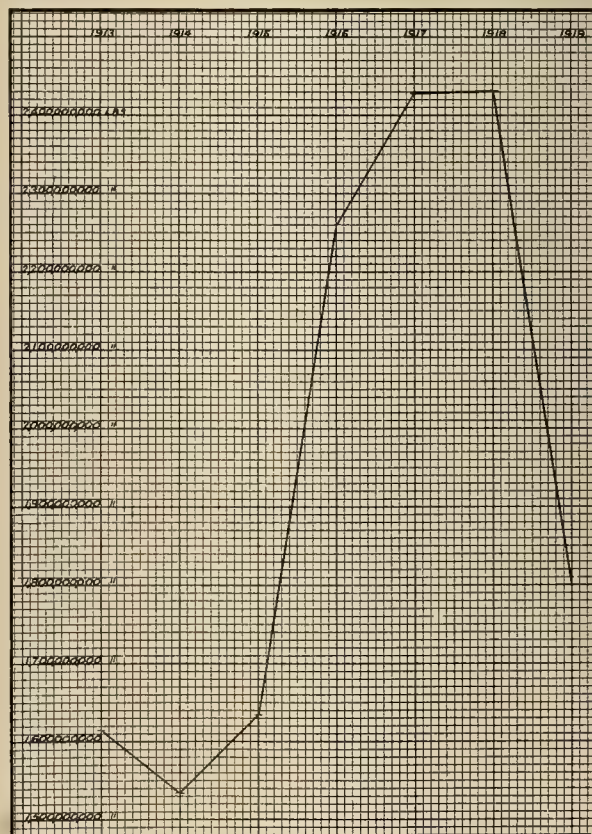


Chart illustrating the copper production of the United States during the past six years

the turn of events during the past year. Immediately after the Armistice was signed there was an evident anticipation of a sustained and pronounced demand for copper to meet the great need of that metal for reconstructive purposes. When it became apparent that this demand would not materialize due to political, financial, and labor troubles, the industry was faced with the problem of disposing of an enormous copper surplus which at the beginning of 1919 was estimated at 1,500,000,000 lb. Today, while there is still a large surplus of copper in the United States awaiting market, foreign orders are in sight which make the situation appear more optimistic. In some quarters it is estimated that manufacturers are consuming about 75% of normal refinery production. In former years the domestic demand consumed about one-half the production. The curtailed output of the copper mines will insure keeping the surplus reasonably low.

The figures below will give some idea of the enormous and sudden curtailment in production that has taken place during the last year:

COPPER PRODUCTION IN U. S.

1913	1,615,000,000 lb.
1914	1,533,781,000 "
1915	1,634,000,000 "
1916	2,259,000,000 "
1917	2,428,000,000 "
1918	2,432,000,000 "
1919 (estimated)	1,800,000,000 "

Exports of copper for November show a marked decrease from October and were only about half the amount exported in September, while imports increased, totaling 52,800,383 lb. for November as against 28,043,510 lb. in October. Thus it appears that more copper is coming into the United States at the present time than is leaving it. While figures over one month are not very significant, should this ratio continue it would be a disturbing and unhealthy factor in the copper situation.

TRADE NOTES

In Charge of Industrial Furnaces —

George P. Mills, formerly electrical sales engineer of the General Electric Company, Philadelphia, has joined the staff of the Electric Furnace Construction Company, Philadelphia, to take charge of and specially develop electrical industrial heating furnaces.

Warehouse to be Moved —

The National India Rubber Company of Seattle will move its warehouse and office from 524 First Avenue South to 570 First Avenue South on or about the first of July.

Change of Position —

J. C. Manchester, district manager of the Economy Fuse and Manufacturing Company, has resigned his position with that company to become distributor of the Distel Wheel in southern California and Arizona. George C. Bryant will become the manager of the Economy Fuse and Manufacturing Company, succeeding Mr. Manchester. George W. Davis, Los Angeles representative for the Economy Fuse, will assist Mr. Manchester in the distribution of the Distel wheel.

Extension of Branch Offices —

The Milliken Brothers Mfg. Co., Inc., Woolworth Building, New York, manufacturer of steel transmission towers, radio towers, steel poles, and all-steel industrial buildings, known as Milliken Buildings, is now devoting a large part of operations to the last noted specialty. These buildings are used by electric companies for substations, storage buildings, warehouses, and other utility structures. To give customers best attention and service, the company has arranged for branch offices in the following cities, with representatives as noted: Chicago, Majestic Building, the Gagen Sales Corporation; Cleveland, Builders' Exchange, the Clymonts-Mohrman Company; Raleigh, N. C., Structural Supply Company; Atlanta, Ga., 1317 Third National Bank Building, Beaulieu

& Applewhite; Chattanooga, Tenn., Volunteer Life Building, O. B. Stauffer; New Orleans, La., Ole K. Olsen, 822 Perdido Street; Tulsa, Okla., Industrial Construction Company; Dallas, Tex., 1504 Commerce Street, Moore, Shotts & Wilson Company; Houston, Tex., David M. Duller, Houston Land & Trust Company. M. T. Walsh, Havana, Cuba, will act as sales representative for the company in that territory. The Milliken Manufacturing Syndicate, Ltd., London, will handle business in various European countries, while Australian territory will be covered by Gordon & Gotch, Ltd., Melbourne, Australia, with branch offices in other cities. Headquarters, heretofore located on the eighteenth floor of the Woolworth Building, New York, have been removed to larger offices on the twentieth floor of the same building, effective May 15.

New Building —

The Chicago offices of The Cutler-Hammer Manufacturing Company of Milwaukee and New York have been removed from the Peoples' Gas Building, where they have been located for the last eight years, to the company's own building on the new Michigan Boulevard link. Because of the rapidly growing business in the Chicago territory the fifteen offices comprising the C-H quarters in the Peoples' Gas Building were no longer large enough, so that the new building was necessary.

Paul Howse, president of the Electrical Products Corporation of Los Angeles has, with his associates, developed what many term the best equipped sign factory in the United States. The story of the development and present success of this company is told in an article which appears on other pages of this issue of the Journal of Electricity. Mr. Howse deserves credit for what he has done in opening up a market for electric signs in the Orient and in developing the idea of interchangeable signs for theatre fronts.



Heckert L. Parker, who has recently resigned as vice-president and secretary of the Conneaut Metal Works of Conneaut, Ohio, has opened a manufacturers' agency at 111 New Montgomery Street, San Francisco, and will represent the Seidler-Miner marine electrical signalling apparatus consisting of signal and fire alarm equipment and inter-communicating telephones and will also represent the Globe Machine and Stamping Company of Cleveland, Ohio, who manufacture the Sepco line of electric heating devices. In addition



to this Mr. Parker will act as agent for the Conneaut plastic metallic packing lines. Mr. Parker, who is an associate member of the A. I. E. E. and a member of the I. E. S., has had wide experience in marine electrical work, having served as a member of the committee on electrical specifications in charge of the electrical work on the Leviathan, which is now being reconconditioned, and was the manufacturers' representative appointed to work out the ornamental electrical fixtures and illumination features with the naval architects and electrical engineers of the private yards who are now building passenger vessels for the U. S. Shipping Board.

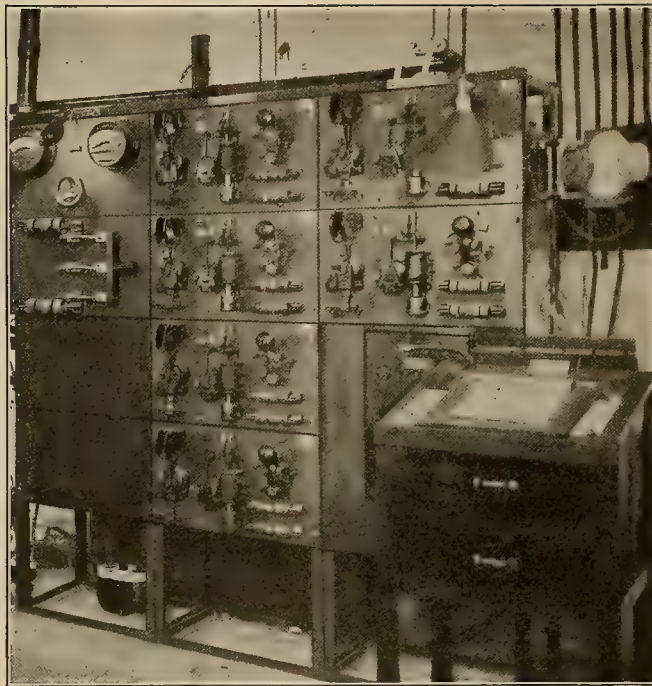
LATEST IN EVERYTHING ELECTRICAL

(The electric truck is daily being more widely used in every type of industry and for this reason considerable interest is centered around the automatic charging equipment described on this page. Those concerned with interior illumination will be interested in the bracket and cluster which are described and illustrated here. Electricians and mechanics will find that the tool chest presented on this page possesses several unusually convenient features.—The Editor.)

AUTOMATIC CONSTANT POTENTIAL CHARGING EQUIPMENTS FOR TRUCKS

The new automatic type of constant potential charging equipment shown in the accompanying illustration is manufactured by the Cutler Hammer Manufacturing Company, of Milwaukee and New York. This is a unit section to be mounted on the standard floor-type frame for charging electric trucks.

It consists of a slate panel carrying a single pole magnet switch, a solenoid relay, a manually operated main line switch and two enclosed fuses. The panel is 15 inches high and 24



The constant potential charging equipment shown above is for charging the electric truck which is becoming so popular in every type of industry.

inches wide, and is drilled for mounting on the standard floor-type frame, which is capable of assembling from one to four sections. Each section is a complete charging unit in itself, and they may be assembled as needed, like the sections of a bookcase. The charge is started by moving the main line switch, which is mounted on the right of the panel, to the "on" position and inserting the charging plug in the battery receptacle.

The main switch may be left in the "on" position and the charge started by simply plugging into the battery. The panel automatically takes care of the charging rate so it is properly tapered, and an attendant's presence is not necessary until the charge is complete, when he terminates it by moving the main switch to the "off" position or by pulling out the charging plug. The charge can also be discontinued by the opening of a shunt trip circuit breaker controlled by an ampere-hour meter on the vehicle.

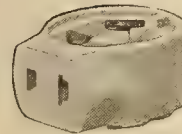
The solenoid relay, which is set in motion by inserting the charging plug in the battery receptacle, is sufficiently retarded by a dash-pot to insure being seated before the magnet switch closes to complete the circuit. A duplex meter

mounted on a swinging bracket to the right of the frame gives simultaneous readings of the charging current and battery voltage when the main switch is moved to the third, or "meter reading" position. A spring automatically returns the switch from the "meter reading" to the "on" position. The charge is automatically given a tapering rate by means of a fixed resistance, which is designed with a proper capacity for the battery to be charged.

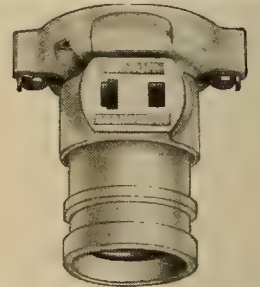
SPARTAN CURRENT TAP

For use in connection with the sockets and bases of the interchangeable porcelain line, the Bryant Electric Company, of Bridgeport, Connecticut, have recently produced the current tap shown in the illustration below.

This device is made of porcelain with a glazed finish. It is designed for convenient insertion between the porcelain base or cap and the socket to provide an extra outlet for connecting extension cord devices such as fans, portable lights



The new current tap designed to provide an extra outlet for connecting appliances.



and water heaters. The tap part is of the standard Spartan Type which will take any of the standard parallel blade plugs.

The arrangement of terminals is such that current can be used off the tap without interfering with the use of a lamp in the socket.

TOOL CHEST FOR ELECTRICIANS

A new tool chest for electricians, mechanics, etc., is the "Utility" type manufactured by the Union Tool Chest Co., Inc., of Rochester, N. Y. It is made in two sizes, 16 inches and 19 inches, and has a tray fitted with movable partitions. The tray is fixed to the cover and is automatically raised out of the way when the chest is opened, leaving the contents of both chest and tray easy to reach.



The Utility type tool chest for electricians and mechanics. This view shows how the tray is conveniently out of the way when the chest is opened.

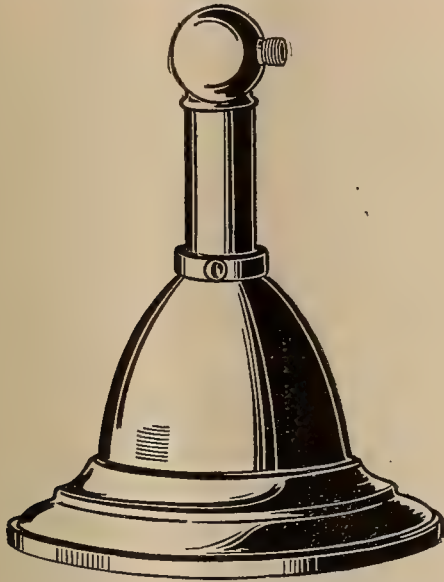
The handle is genuine leather, steel-cored, and is attached with heavy cotters which prevent its being pulled out of the heavy nicked steel loops. It will carry any weight.

FIXTURES FOR THE HOME

Three-Piece Bracket

This new E-Z wire three-piece bracket put on the market by the Peerless Light Company is a combination of three distinct attachments.

The arm, No. 1891, is the regular single piece, made of solid brass and similar to the No. 1978 cast arm but made of high-grade drawn brass tube throughout. This single piece



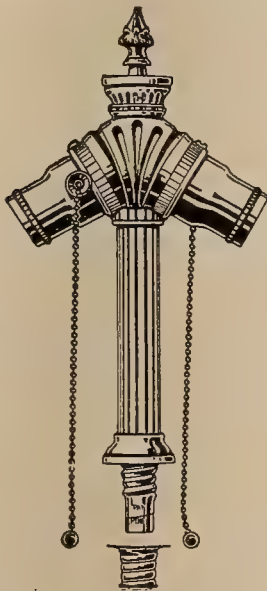
The new E-Z, Three Piece Bracket

arm gives its service, formerly secured by assembling a number of individual attachments.

The slip canopy is the standard No. 1120 and the $\frac{3}{8}$ -in. crowfoot is No. 617. All the surface parts are of the B-B. finish.

Double-Duty Cluster

The double-duty cluster is so named because it combines simplicity of construction, artistic appearance, and service. The cluster is a one-piece casting of high grade brass. Its sturdy construction enables it better to withstand the jar-



This cluster is an example of the type of fixture which adds to the beauty and convenience of any room. Sturdy structure does not detract from the appearance yet adds to its durability.

ring effects of switching on or off the lights. It is equipped with two pull chain sockets giving individual control of the lamps. In another form it is completed with one keyless socket and one pull chain socket, so wired that both lights are controlled by one motion.

Book and Bulletins

Drainage Engineering

By D. M. Murphy. 178 pages, 6 x 9; well illustrated. Published by McGraw-Hill Book Company, New York, and for sale by Technical Book Shop, San Francisco.

Drainage is so inseparably associated with land reclamation and food production in the West that irrigation and agricultural engineers and students should welcome this new volume as a help in their work. The author was for many years associated with the U. S. Reclamation Service as drainage engineer and during that time, as well as during his subsequent consulting practice, has had an unusual opportunity to observe and interpret drainage problems. This text gives to the engineer the results of the author's observation and experience in a form that can be applied to the solution of his own problems, whether they concern the draining of natural swamps or water-logged lands. The first three chapters are devoted to a discussion of soils, growth of plants and water supply. Then follow three chapters on drainage, including fundamental factors, benefits and methods of investigation. The next three chapters have to do with construction, location and capacity of drains. The final chapter discusses economic considerations.

Direct Current Motor and Generator Troubles

By T. S. Gandy and E. C. Schacht. 274 pages, $5\frac{1}{2}$ x 8; 109 illustrations. Published by McGraw-Hill Book Company, New York, and for sale by Technical Book Shop, San Francisco.

It is most refreshing in these days of multifarious book production to find one written by men who know what they are writing about and know how to impart this knowledge. Such is the case with this new book. Furthermore, it goes at once to the heart of its subject, telling why a d.c. motor or generator does not run and how to make it run. From observed symptoms the operator is taught the cause of any given trouble and told how to remedy it. It is essentially a book for the operating man, not the designer. He is told how to select a motor or generator to meet given requirements, how to erect the machine, how to start it, keep it running, test it and repair it. It is a concise, practical and usable text that should be in the hands of every man who handles d.c. equipment.

Elements of the Precision of Measurements and Graphical Methods

By H. M. Goodwin. 116 pages, 6 x 9. Published by McGraw-Hill Book Co., New York City, and for sale by Technical Book Shop, San Francisco.

This text shows how to apply the mathematical laws of error to experimental observations. The author is professor of physics at the Massachusetts Institute of Technology. While it is written primarily for the use of students in the physical laboratory it should prove of value to engineers engaged in experimental testing. The purpose is to illustrate the practical use of the theory of probability and the method of least squares. The first part of the book discusses principles and computations, the second part is devoted to graphical methods and the third part to problems and the solution thereof. This is a second edition of a work well adapted to the use of those who wish to work up the subjects without additional instruction.

Trade Bulletins

The Delta-Star Electric Company, Chicago, Illinois, are distributing bulletin number 303, describing their 100-amp., 600-volt, three-phase plugs and receptacles, for extra heavy duty. These equipments are included in the list of electrical appliances issued by the Underwriters laboratories. Copies are sent upon request.

NEW ELECTRICAL DEVELOPMENT

(The Northwest reports plans for the construction of several hydroelectric plants. Arrangements for the power supply of East Bay cities and a report of threatened power shortage appear among Pacific Central items. The proposition of a municipally owned electric power plant appears in the Pacific Southwest section while the Intermountain district reports increases in rates as well as plans for the enlargement of power plants and the development of additional hydroelectric power.—The Editor.)

THE PACIFIC NORTHWEST

BEND, ORE.—Larger power developments are to be made by Bend Water, Light & Power Company calling for 4233 horsepower on Tumalo Creek.

SCIO, ORE.—State Engineer, Percy A. Cupper, grants this place a right to appropriate water from Thomas Creek for the development of 362 horsepower for municipal purposes.

CENTRALIA, WASH.—The Kane Pneumatic Shock Absorber Company of this city is to build a 1500-kw. power plant at Ford's Prairie, according to President P. W. Kane of the company.

SPOKANE, WASH.—The International Portland Cement Company will construct a quarry at Portrock, Idaho, on the Pend Oreille lake, according to G. A. Irvin, treasurer and general manager of the company. The sum of \$50,000 is being spent on a power plant and crusher alone.

SHELTON, WASH.—County commissioners have granted to Olympic Electric Reduction Co. a franchise to transmit electric current over the roads of Mason county. This company holds power site and rights of Frank McKean in the Skokomish river and already has a tunnel driven to conduct water for turbine purposes.

SEATTLE, WASH.—Condemnation proceedings started by the city of Seattle in its plan to build a power plant on the upper Skagit river will be opposed by Whatcom county. The action will be based on the theory that the proceedings, if successful, would take \$3,000,000 worth of taxable property off the rolls of that county.

ENTERPRISE, ORE.—Construction work utilizing the waters of the Wallowa river is to be started shortly by the Enterprise Electric Company. The first unit will develop 1500 hp. and developments up to 15,000 hp. can be made when occasion requires. It is expected that this will be the largest hydroelectric plant in this part of the state.

VALE, ORE.—J. Edwin Johnson of this place has applied to the state engineer for permit to appropriate 100 second feet of water from Malheur river for development of power for pumping, irrigation, municipal lighting and mechanical purposes. A dam is to be constructed and other work done. Total cost of the plant is estimated at \$300,000.

PRINCE RUPERT, B. C.—Estimates of the engineer in regard to two hydroelectric projects, Thulme river and Shawatans, were tabled at a recent session of the city council. First of these projects would cost \$700,000 and the other \$268,500. T. C. Duncan, the engineer, states that to make a detailed report on the two installations would cost another \$20,000.

SEATTLE, WASH.—The city council of Seattle has passed, over the veto of the mayor, an ordinance increasing the city light and power rates twenty per cent. By the new ordinance the minimum monthly charge for lighting in residences will be raised from 50 to 75 cents and commercial light rates will be raised from 11-3 cents to 11-2 cents a kw-hr. as a minimum to 4½ and 5½ cents a kw-hr. as a maximum.

OREGON CITY, ORE.—A power plant that will develop 45,000 hp. is proposed in Clackamas county. Joseph R. Keep, 313 Couch Building,

Portland, has filed application with State Engineer Percy A. Cupper for permit to appropriate 4000 second feet of water from the Sandy river and all its tributaries for power for general use. A large concrete dam will be constructed but the cost of developing the project has not yet been estimated.

SPOKANE, WASH.—It is reported that development of Z Canyon on the Pend Oreille river at Metaline Falls, one of the largest hydraulic projects in the West, is imminent. The water power rights at that point stand in the name of the Lead King Mines Company and it is anticipated that a visit will soon be made to the project by Hugh L. Cooper, international engineer, who in 1914 estimated the cost at \$20,000,000 with a resulting production of 400,000 horsepower.

SEATTLE, WASH.—Figures have been received by the Board of Public Works for installation of a water power wheel and generator at Nehalem Creek and because of the special specifications covering the equipment were referred to Hydroelectric Engineer C. F. Uhden for examination and report. The figures received varied according to the weight of materials and other points, and range from \$18,000 to \$47,000 on water wheel and from \$14,000 to \$22,000 on the generator. Bids were received from Westinghouse Electric & Manufacturing Company; Allis-Chalmers Manufacturing Company; S. Morgan Smith; Pelton Water Wheel Company and Allen Cunningham of Seattle.

THE PACIFIC CENTRAL DISTRICT

OAKLAND, CAL.—With rates identical to those provided in their current contract, the Pacific Gas & Electric Company was awarded the contract by the city council for supplying the city with heat, light and power for the fiscal year 1920-1922. The bid as originally presented to the city council called for a rate of 85 cents per thousand cubic feet of gas, which exceeds by 10 cents the present rate. The company was permitted, however, to change its bid to 75 cents a thousand cubic feet. The contract calls for heat, light and power for all city departments and dredging operations.

REEDLEY, CAL.—Sealed bids will be received until July 6th for \$4,555.98 bonds to pay the cost of an underground conduit system and installation of electroliners.

WILLOWS, CAL.—A petition is being circulated by Glenn-Colusa irrigation district calling for a bond election to be held in July for \$2,587,000—interest 6 per cent.

REDWOOD CITY, CAL.—A deed has been filed transferring 7 acres of land on the marsh to the Beresford Country Club agents to secure a supply of water for the club grounds.

PLACERVILLE, CAL.—By a ratio of 5 to 1, Placerville has voted to issue bonds for the establishment of a municipal water supply. It is planned to purchase the present water works and to extend and improve the system.

SAN FRANCISCO, CAL.—A contract has been awarded by Architect C. B. Farlow, Holbrook Building, to Chadwick & Sykes, Crocker Building, for the erection of a one-story steel and concrete power house on the south side of Stevenson street, east of Second street, for the United Railroads.

SAN FRANCISCO, CAL.—The Sierra and San Francisco Power Company, which prior to the time it leased its properties to the Pacific Gas & Electric Company obtained from the Railroad Commission authority to issue \$1,000,000 bonds, has filed an application asking leave to issue the bonds to the Pacific company. The delivery of the bonds is provided for in the lease.

SIERRA CITY, CAL.—Engineers are engaged in making surveys for a series of large storage dams in the North Yuba river, between Sierra City and Indian valley, the water to be utilized for power purposes. It is stated that the Yuba Development Company is behind the big project, and that it promises to develop into one of the large electric power schemes in California.

LEWISTON, CAL.—The Pacific Gas & Electric Company has taken over the power plant of the Trinity Dredging Company and will operate it under a short-term lease. The plant, which develops about 600 horsepower, has been idle for several years. It will be used to augment the power circuits of the Pacific Gas & Electric Company. About 30 men are at work preparing the plant for operation.

DELANO, CAL.—The capacity of the Delano water works is to be increased. The community uses 200,000 gallons a day, which is barely sufficient for consumers. To provide funds for the proposed new water equipment, the present minimum rate of \$1.50 for 5,000 gallons will be raised to \$2, with 10 cents for the next 1,000 gallons and 5 cents per 1,000 gallons thereafter. The new rate became effective July 1.

MODESTO, CAL.—Del Monte Properties Company, of which S. F. B. Morse is the president, is beginning construction of a concrete dam to store 750,000,000 gallons of water for irrigation of Los Laureles ranch to augment the water supply on the Monterey peninsula for domestic use and to water the new pleasure grounds and golf course planned by the company. According to Morse the water in the lake will meet domestic needs of the Monterey peninsula for 100 years and eventually supply Monterey, Carmel and Pacific Grove.

SAN FRANCISCO, CAL.—Inventory has begun of the property holdings, watersheds, reservoirs and distributing system of East Bay Water Company for submission to the mayors of Oakland, Berkeley, Alameda, Richmond and Emeryville, as the first step toward negotiation for joint municipal acquirement of the properties. The territory involved extends for 35 miles from San Leandro to Richmond. The purchase of facilities would give the municipalities sources for future development at Cull and Crow creeks of 11,000,000 gallons.

WILLOWS, CAL.—The threatened power shortage has begun to materialize. Within the past few days, due to low voltage, many motors have been burned out, and the power reduced to such an extent that the pumps fail to throw the necessary amount of water. The officials of the power company state that they are already running their steam plants to full capacity, in addition to the regular water-driven generators. These steam plants furnish about 112,000 hp. The peak of the power load has not yet been reached, as it is expected that the requirements during July and August will be much more than at present.

MODESTO, CAL.—The board of directors of the Modesto Irrigation District visited San Francisco recently for the purpose of interviewing John A. Britton, general manager of the Sierra Power Company, the state bonding commission and city officials. An agreement was made with San Francisco for the crossing of the Don Pedro site with the pipes that are to convey the water from Hetch-Hetchy to San Francisco. Three projects were presented to the Sierra Power Company for the power they seek. One plan is for the irrigation district to buy out the right of way, a second is for the irrigation district to supply a certain amount of power to the company to be allowed water to make their own power as they now do.

SAN FRANCISCO, CAL.—The Blankenhorn-Hunter-Dulin Company and the Anglo-London & Paris National Bank are offering an issue of \$750,000 James Irrigation District (Fresno county) 6 per cent Serial Gold Bonds, due January 1, 1928 to 1942 inclusive. The James Irrigation District is comprised of 26,648 productive acres, located 24 miles southwest of the city of Fresno. The actual value of the net acreage within this district is appraised at \$3,916,155, or \$150 per acre. These bonds are a legal investment in California for savings banks, commercial banks, trust companies, trust funds, insurance companies, school funds, and are valuable to secure public deposits. They are totally tax exempt in California and exempt from the federal income tax, and are being offered at prices to yield 6.20 per cent.

THE PACIFIC SOUTHWEST

RIVERSIDE, CAL.—The Southern Sierras Power Company is planning to construct a water softening plant soon at its San Bernardino plant to cost \$20,000.

BREA, CAL.—A special election will be held August 3 for the purpose of voting on a bond issue for \$75,000, for the construction of a municipal water system.

LOS ANGELES, CAL.—Bonds will soon be voted on for the installation of a proposed ornamental post lighting system in Hollywood. The estimated cost is \$30,000.

PASADENA, CAL.—Ten thousand feet of new mains will be laid this summer in Pasadena and Altadena by the Los Angeles Gas & Electric Corporation. Work is to start at once.

LOS ANGELES, CAL.—Plans of the Southern California Edison Company for future development, include the expenditure of a million dollars every month for the next ten years.

SAN BERNARDINO, CAL.—Third Street will be lighted from Arrowhead to Mt. Vernon Avenue, with new reinforced concrete posts with three lights each. Bonds will be voted to cover the cost of construction.

WINSLOW, ARIZ.—Ordinance No. 93 provides for a special election to be held July 24th, for the purpose of voting on a bond issue for \$39,000 to be used for the purpose of purchasing a gas plant and equipment.

LANCASTER, CAL.—No bids were received for bonds issued for the construction of the water works district at Lancaster. It is planned to form a syndicate among large land owners and purchase bonds at par and distribute to subscribers to the fund.

EL CENTRO, CAL.—Plans of Engineers Chester Allison and Francis Sollow to build an immense storage reservoir at Volcano Lake to force the Colorado River back into its old channel will soon be made public, at a meeting of the Imperial Valley Bankers' Association.

BRAWLEY, CAL.—A municipally owned electric power plant for Brawley at a bond issue cost of \$200,000 is proposed and will come before the council at its next meeting. The proposition embodies construction of a dam across the Alamo river at Alamorio. The plant itself is to be constructed in three units of 150 kw. each.

THE INTER-MOUNTAIN DISTRICT

FLORENCE, IDA.—An electric light and power plant is being installed here.

GREAT FALLS, MONT.—A resolution has been passed by the city council providing for a lighting system on First Avenue, South, to cost about \$25,000.

MISSOULA, MONT.—According to Mayor John P. Swee, a preliminary power permit has been granted this place for the development of electricity for heat, light and power.

DUBOIS, IDA.—The village board at its regular session on June 17th fixed a minimum power rate of \$7.50 per month. This covers the expense of installing transformers by the city.

HUNTINGTON, UTAH.—Extensive improvements are being made in Huntington, one of the most important of which is extension of the street lighting district, to cover the entire town.

EPHRAIM, UTAH.—For the second time in ten years the city electric light plant has been run for some time on the water from Maple Creek run. At the present time the city is unable to use more than half of the water in Maple Creek.

TOOELE, UTAH.—Work is to start at once on the 1000-ton concentrator which the Utah Consolidated Mining Company is to erect here. This new plant will take care of low-grade ores. The mill will be operated by electric power.

NEPHI, UTAH.—Nephi City, through its mayor, has applied to the Public Utilities Commission of Utah for permission to increase its rates for electric energy for lighting and power. The present rates and the increases asked are not given in the petition.

HELENA, MONT.—Application has been filed with the registrar of public lands by the Rocky Mountain Company of Butte for a permit to develop water power on the Flathead river. The proposed development would involve construction of five dams with an expenditure of from \$5,000,000 to \$10,000,000.

CALDWELL, IDA.—Final conclusion has been reached in the matter of settlement of purchase of the McNeil branch of Caldwell Traction Co. by farmers and business men. J. B. Franklin, Boise engineer, recently inventoried the property, estimating its value at \$60,000. He also made an estimate of the cost of building a line to Pickle Butte Bridge, about 2 miles, three-fourths of a mile being already graded.

MISSOULA, MONT.—Papers have been received here from Helena granting permission to form a corporation for the development of a power plant on Rock Creek. The new company will be incorporated for \$500,000, a majority of this amount to be spent in the erection of a large hydroelectric power plant at the mouth of Rock Creek, east of Clinton. It is the intention of the new company to erect a plant that will generate about 20,000 horsepower, the greater part of which will be used for irrigation purposes.

MILFORD, UTAH.—The town of Milford, a municipal organization, has filed a complaint with the Public Utilities Commission of Utah, declaring that the Telluride Power Company, which has been furnishing the town with electric energy to pump water for the municipal water plant, has more than doubled the rate which had been paid prior to the first day of the current year, and has presented bills which the town trustees declare to be excessive. The municipality demands a hearing and that the old rate remain in force.

GRANGEVILLE, IDA.—A considerable sum of money will be spent by the Grangeville Electric Light & Power Company in enlarging its plant at the mouth of Lolo Creek and the voltage of all the company's lines will be increased from 6600 volts to 23,000 volts. This is to be brought about by raising the dam at Lolo Creek where a new water wheel will be installed. Other improvements include a new pipe line and new

generator. These improvements were made necessary by great increase in company business, particularly at Orofino, Idaho.

BOISE, IDA.—Complaints from Lewiston have been received by the public utilities commission of Idaho alleging that the Washington-Idaho Light & Power Company is dismantling its steam plant across the river in Washington. This plant enables the company to supply standard service during the time when the stream which usually supplies the power is frozen up, or the water plant otherwise crippled. Lewiston citizens fear the menace of fire with no reliable power for pumping, and the railway there also depends upon the system for power.

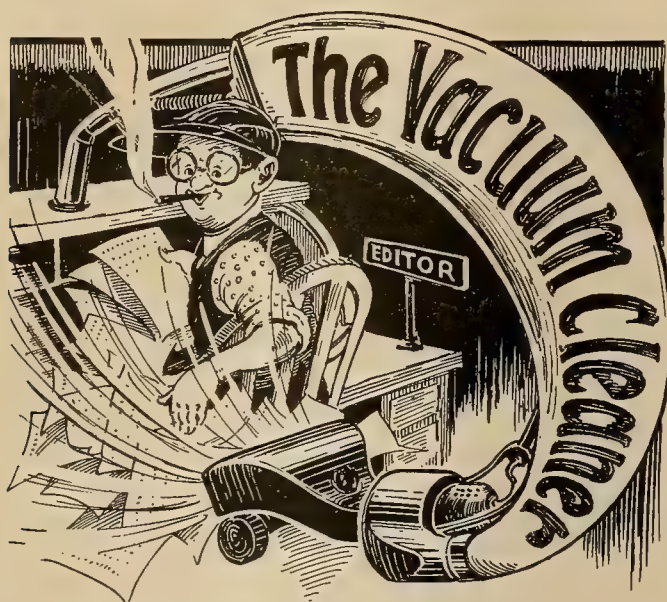
SALT LAKE CITY, UTAH.—The Bamberger Electric Railroad Company has filed a petition with the Public Utilities Commission of Utah, requesting an increase of 100 per cent in rates charged for the transportation of milk and cream. This company operates a special milk train between Salt Lake City and Ogden, and it is claimed that this milk train is operated at a loss at the present time, due to the large decrease in milk traffic. This decrease is caused by the fact that most shippers are now using trucks, except when weather conditions are bad.

MISSOULA, MONT.—A preliminary power permit has been granted the town of Ronan by the department of the interior, for the purpose of developing electricity for heat, light and power, in Crow Creek canyon, four and a half miles northeast of that city. Work on the plant will be started in the near future. Under the permit development will have to be made within the next 12 months. This will make possible the furnishing of electricity to other towns on the reservation other than Ronan. A new system of street lighting has been installed and was put into operation about July 1.

LOVELAND, COLO.—Right of the city of Loveland to bring condemnation proceedings to secure the distribution system of the Western Light and Power Company within the city, in connection with the municipal electric plant, has been upheld in the district court at Fort Collins. The court overruled the power company's demurrer to the petition to condemn and sustained the city on eight out of nine contentions. This means that the condemnation suit must go to trial on its merits. The company was granted fifteen days in which to plead. It is not expected that the condemnation suit will come to trial before the September term of court.

KAMAS, UTAH.—The public utilities commission of Utah has issued an order, in the application of the Kamas Light, Heat and Power Company, in which the public utilities commission retains jurisdiction of the case. The petition was for permission to increase rates. The commission grants an increase, but will closely watch the result of operations under the rates prescribed and will, if it is found necessary or advisable, modify its order to meet conditions existing later. The new rates for lighting are as follows: Minimum per month, \$2.00; residential and commercial lighting, 15c per kw-hr.; Kamas high school, minimum charge \$4.00, meter charge \$10.00; connection charge, \$3.50.

BOISE, IDA.—The Idaho Power Company has filed a petition for a rehearing in the application of that company for the approval of an increase in irrigation rates. The Idaho Power Company petitioned for an increase of 60 per cent in its irrigation rates, and on June 2 was allowed an increase of 10 per cent. The company's petition is made on the grounds that: "The said decision of the public utilities commission is against the evidence. That, while clearly recognizing the inadequacy, unreasonableness and injustice of the irrigation rates sought to be superseded, and while further recognizing the necessity, reasonableness and justice of the increased rates, the order fails to put into practical effect this recognition by any substantial increase in irrigation rates."



Watt's in a name? as our facetious electrical friends continue to remark on all possible occasions. We have just heard a story of a well-known lawyer of Chicago, who made an application to register a trade-mark for "Limestone-Brand," which was denied by the Examiner of Trade-marks on the ground that the medicine contained limestone. He wrote back saying it contained none, then they said it was deceptive. So he prepared a brief on the subject, which included the following statements:

"Ivory is a good trade-mark for soap not made of ivory. Gold Dust Washing Powder is not made of gold. Old Crow Whisky is not distilled from crows. There is no bull in Bull Durham. Royal Baking Powder is not used exclusively by royalty, nor is Cream Baking Powder made of cream. Pearlina contains no pearls, and White Rock is water.

"There is no cream in cream of tartar, in cold cream or in chocolate creams, no milk in milk of magnesia, in milkweed or in the cocoanut. These are all as remote from the cow as the cowslip.

"There is no grape in grapefruit or bread in breadfruit. A pine apple is neither pine nor apple; a prickly pear is not a pear; an alligator pear is neither a pear nor an alligator, and a sugar plum is not a plum.

"Apple butter is not butter. All the butter is taken out of buttermilk, and there is none in butternuts, or in buttercups, and the flies in the dairy are not butterflies.

"Peanuts are not peas, and it is doubtful if they are nuts. Sailors wear pea-jackets—peas do not, they have peascods, which, by the way, are not fish."

We might add also that a horsepower does not eat oats, a knife switch is no good for cutting bread, a foot-candle is not a device used by chiropodists, and insulator pins are worthless for dressmakers.

* * *

Collectors of the series known as "Foolish Question number 997" will welcome the following:

The commuter reached the station platform just as the 5:15 was pulling out. A little burst of speed before the admiring onlookers netted him fifty feet in overcoming the train's handicap but it was a losing race. He quit at the end of the freight yard and returned.

"Miss your train, sir?" inquired the porter cheerfully.

"Oh, no, I was just chasing it out of the yard."

Illumination is a growing science, and apparently a very subtle art. We quote the following from the abstract of an address on illumination:

"In regard to pulpit lighting he suggested that neither the lamps nor the inside of the reflectors to be exposed to view, that the preacher's face to be about 4 foot-candles, so that every expression is observable, that the reflectors to be well clear of the preacher's head but not too far for economy of lighting, and that the switch for the desk lamp be arranged to be operated from the pulpit."

We notice no mention is made of the location of the switch for the reflectors, but if these too are operated from the pulpit there may come to be new meaning in descriptions of this kind: "The torrent of his words bore him along; his expression became rapt and a great light seemed to illumine his countenance."

* * *

Fish stories and golf stories are familiar enough in the electrical industry but golf strokes and fish have nothing on some industrial plants. The following is quoted verbatim:

"The climate in this locality is very extreme. It is said that the gas went off in the cook house one day, and the cook, whom one would think to be quite worried over the matter, calmly moved the stove out in the sun. That afternoon the wind changed to the north and a steam pipe froze between the boiler and the pressure gauge. The formation of the ice caused the pressure gauge to rise. When it reached 130 pounds the safety valve was supposed to blow, and while the fireman was cutting off the fire and turning on the feed water the pressure had reached 150 pounds. The fireman next blocked the safety valve open and the gauge showed 180 pounds. By that time every one had left and was standing around at a very safe distance, waiting for the expected explosion. Finally one of the braver men went back into the boiler room and discovered 200 pounds pressure on the gauge and none in the boiler."

* * *

In the news columns of a daily paper we note a reference to a "stalled capacity of 10,000 horsepower." A singularly well-stocked stable for these days of automobiles.

* * *



It has always been difficult to get the aesthetic and the scientific to see things the same way. Look what happens when the artist hears the engineer mention a "worm-driven drum."

JOURNAL OF ELECTRICITY

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Vol. 45, No. 3

SAN FRANCISCO, AUGUST 1, 1920

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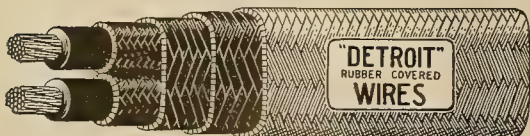
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ROBERT SIBLEY, Editor

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UNIVERSITIES OF THE WEST

IN these great institutions of learning has been fostered the vision that has become the heritage of each of their graduates, leading them on to accomplish the seemingly impossible and to find the way out of the problems, technical and social, that have had to be solved by the men of the West. The spirit of the pioneers found expression in these universities and their belief in the possibilities of this vast empire, west of the Rockies, is the inspiration of those who follow in their footsteps.



JOURNAL OF ELECTRICITY



DEVOTED TO THE UPBUILDING OF THE ELECTRICAL INDUSTRY IN THE WEST
AND IN THE COUNTRIES BORDERING THE GREAT PACIFIC

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Publishers' Announcement

It is with great pleasure that the McGraw-Hill Company, Inc., hereby announces that the confidence it has always felt in the Pacific Coast, its resources, its past attainments and its vast possibilities for future development has during the past year been greatly strengthened due to the support and friendly good feeling that have been shown from all quarters of the West to the McGraw-Hill service on the Pacific Coast through the Journal of Electricity and the ten other engineering and technical magazines of our company. We have in view the enlarging of this service, the broadening of the activities of the Journal of Electricity to embrace to an even greater extent the industrial activities of the West and its possibilities for future growth and development.

To this end a reorganization of our Pacific Coast office has been found necessary. When the McGraw-Hill Company purchased the Journal of Electricity last year, plans were made to dissolve the Technical Publishing Company Jan. 1, 1920, but a delay was caused by the printers' strike in New York. Our plans now, however, are all perfected. After Aug. 31, 1920, the Journal of Electricity will be published direct by the

McGraw-Hill Company, Inc., at its San Francisco office, Rialto Building, the Technical Publishing Company being dissolved. Under the new arrangement Mr. Robert Sibley, editor of the Journal of Electricity, becomes the executive head of the San Francisco office as chairman of the Pacific Coast Executive Committee, which committee consists of three other members of our Pacific Coast staff, H. W. L. Gardiner, who is to be the new business manager, N. A. Bowers and A. H. Halloran. The committee will not only direct the affairs of the Journal of Electricity, but also all of the Pacific Coast activities of the McGraw-Hill Company.

At the time of the purchase of the Journal of Electricity, Mr. W. M. Deming kindly consented to remain with the Technical Publishing Company as its president and general manager until the company was dissolved or other arrangements were made. As he is now leaving us I should like to take this opportunity to express my sincere appreciation of the work which he has done, and to extend to him the cordial good wishes of the many friends he has made in the McGraw-Hill Company.

JAMES H. MCGRAW, President.

The Water Power Committee Report presented to the National Electric Light Association Convention at Pasadena during recent weeks has created a profound impression. That the vast sum of over \$700,000,000.00 must be expended in hydroelectric development in the West during the next nine-year period not only awakens an interest in the possible purchasing power of the West throughout the manufacturing centers, but it also has a vital message here at home. To furnish the proper man power for undertakings which involve such vast financial investment, and which are of such prime importance to industry and agriculture in the West, a new and emphatic duty falls upon our universities.

To such institutions as the California Institute of Technology at Pasadena, the University of Southern California in Los Angeles, Leland Standard Jr. University at Palo Alto, the University of California at Berkeley, the University of Washington at Seattle,

and Washington State College at Pullman, all of which are designed to train men to handle technical duties of the commonwealth they serve, this subject is of profound importance.

President Barrows, of the University of California, in an address before the San Francisco Electrical Development League recently, stated that the University of California was looking for every opportunity of increasing the service that institution could render to the people and industries of California and the whole West. It appears, without question, to the electrical industry that the following logic is unassailable: The future development of the industrial and agricultural resources of the West is inseparably bound up with the development of the potential water powers and fuels of this region. These will produce electrical energy to do the work of the West which cannot otherwise be accomplished successfully.

Abundant evidence is at hand which proves that in this district progress has followed, and will continue to follow the development of these natural

resources; and without such development progress will languish. In one comparatively small community alone it has been found that the shortage of sufficient electrical energy to supply all applicants, due to post-war financial conditions and the drought, has postponed the cultivation of thousands of acres of rich farm land and because of this fact the immediate construction of city homes representing an investment of ten million dollars was stopped.

The second premise is that the vast water powers of the West cannot be developed without the application of trained workers. The trained workers must be reared and educated where they may be imbued with the daring spirit and vision of the West. Thus alone can they carry out the magnificent program already visualized, which is indeed unique to this section of the world. An approximate census of the great power companies in the commonwealth of California alone shows that at this time there are over two thousand employes holding positions which call for the equivalent of a college education. Experience tells that the number of such employes will increase in almost direct proportion to the increase in the power capacity of the systems. Thus, in this decade, there will be required five thousand, or more, additional trained employes of college grade in this branch of the electrical industry alone.

The inevitable conclusion is that the University of California is not now doing its share in this vital problem. It should not leave the education of these important members of the industry to others, but should assume first place among engineering colleges. The present staff in the Electrical Engineering Department at this university consists of one professor, two assistant professors and one special instructor, although the department ranks fourth among the colleges of this institution. There is one assistant professor on leave. The total enrollment in the College of Mechanics is 615 students, most of whom take electrical subjects.

Before the beginning of another academic year the conditions must be improved and the alumni, and all others interested in the welfare of California's University, are watching the entire situation with the keenest anxiety and expectation.

In summarizing before the A. I. E. E. convention the progress of electrical history during the early part of the 19th century, Professor Magnusson pointed out conclusively that of the six eminent physicists and philosophers who discovered the fundamental laws of electricity and magnetism and their inter-relations five were university professors, and the sixth an independent investigator. Today a survey of the field wherein research studies are made and new applications developed, shows that only a very small per cent of the investigators are within the walls of universities. All the others are connected with the research departments of manufacturing concerns. Great sums are spent for theoretical investigations, which may or may not lead to the development of apparatus for practical application at the time. Although it is

regrettable that the universities have not their former comparative status, yet it is not illogical that those directly profiting from the studies should be the first ones to carry the burden of the expense.

The relation of this problem to the Pacific Coast is quite direct. On the Pacific Coast there are few industrial activities comparable in size with those in Eastern states, and as a result there is not as much research done here as in the East. Professor Magnusson gave as a corollary to this, that greater industrial progress would not be made without the foundation of industrial research. It of course follows that as the industries are not here to foster the research and as the industry will not obtain without research, the alternative is that the universities of the West regain the place once held by universities in research work. If the universities are suitably equipped and have proficient faculties, students who are capable of undertaking research work will be influenced to do this in the universities here, rather than enter the research departments of the Eastern manufacturers.

The determination of the Northwest to reap the benefits of cooperation is seen in the significant fact that an executive committee has been formed in the state of Washington to carry on a cooperative campaign similar to that which has been conducted with such great success in California. Cooperation has been preached for so long that the electrical industry has come to the point where no banquet or convention is complete without at least part of the program being devoted to that subject. Everyone agrees that it is a wonderful thing to have a cooperative movement. Generally that is as far as it gets. Now that the Northwest has taken this vital step forward it is to be hoped that all the Western states will form cooperative campaigns that may eventually be welded into one big cooperative movement that will hold the entire West together so that this region as a whole may gather the benefits that are bound to come from such a movement.

One of the impressive responses to the demands of the war period was the cooperative research work carried on by scientists from all the laboratories of the country. Each man carried on his own work but each had at his command the resources of the entire group. Scientists from one company worked in the laboratory of another, more fitted to the particular experiment they were carrying out, and universities pooled their resources in faculty and equipment in the interests of the important work in hand.

The experience is one of many aspects, but among the lessons which it taught was the value of exchanging laboratory facilities. The time may come when this is done between commercial companies, although for the present such interchange is only a matter of personal courtesy in special instances;

Research and Industry

Cooperation in Education

but there seems to be no reason why it should not be put into more general application by neighboring universities. Laboratory equipment for elementary courses is of course necessary in each institution for the great number of students who take such work, but specially outfitted laboratories for advanced study often mean a tremendous outlay, so that a college cannot afford to specialize along many lines. The European system of universities presupposes that the student will go from center to center to get the work which he wants, but our American system has developed along other lines. Why should not neighboring universities, of which there are a great number in the East and numerous instances on the Western coast, extend the courtesy of such specialized facilities to students of the other colleges and thus permit each institution to build up really complete equipment along its special line without having to scatter its resources?

The article on another page of this issue telling of the interesting apparatus used by the Western Union Telegraph Company carries with it another, and more important message. It is a message of service. Service that is not vital merely to the transmission of a message from one station to another, but essential for the successful continuation and growth of the business. Although a necessary adjunct to the financial and business life of the country, the use of the telegraphed message must be taught to the public. It has been found that the best way to do this is by the rendering of service in its broadest sense. This is natural as the telegraph company is a public utility and, in common with all such, rests upon the cornerstone of service. Without service it cannot succeed, and conversely, with more complete service, it will succeed the better.

Those who attended the industrial lighting exhibit of the Pasadena convention were greatly impressed with the value of such a display as an object lesson for manufacturers and the thought occurred to many that such an exhibit should be a permanent installation in large cities, so that manufacturers could be taken to view the demonstration as part of the selling of adequate illumination. The California Electrical Cooperative Campaign has recently determined upon the opening of two such rooms, one in Los Angeles and one in San Francisco, the educational work in connection with which is to be carried on by the campaign's field representatives in these two cities. In keeping with its progressive work of the past, the California organization has seized upon an important new field of service. With its backing and support of the united electrical industry of its state, it is in a position to take the lead in such matters. Local organizations are following suit elsewhere and among the community needs of the electrical industry which these enlightened groups will meet, the opportunity

to forward the cause of better lighting through the establishment of such illumination demonstration centers should not be overlooked.

The constitution for the new organization of the Federated American Engineering Societies as adopted by the organizing convention in Washington provides that "this organization stands for the principle of publicity."

Publicity for Engineers

The adoption of this principle as fundamental in so far as it signifies an utter abandonment of secrecy is in the spirit of science for which the engineer has always stood; in the sense that it involves an aggressive campaign of publicity, it means a new step for the engineer in the recognition of the ethical necessity of advertising. An amusing series of articles which appeared during the war attempted to prove that the way to win that conflict was to advertise the principles for which we fought to the opposing armies. In spite of the difficulties of reasoning with the contestants in a fist fight, it is nevertheless a fact that progress can only come through a clearer understanding of the issues involved in any question and that in a very real sense, the side which is best advertised, wins. In a democracy the whole fabric of conditions which surround living are determined by the enlightenment or ignorance of the public. The engineer has always stood in the forefront of progress and, in common with most of the elements which go to make up this vanguard, has made little or no effort to mold public opinion. His work is inconspicuous in nature—it is not, as a rule, until he has finished with it, that it comes to the attention of the public, and his opinion has had no such weight in forming public thought as that, for instance, of organized labor. And yet the hope of a republic is in the use which it makes of its experts. It is to the interest of the community as well as to the engineer that he make an active effort to advertise his standpoint—and the engineering societies have taken a step forward in thus taking up this responsibility.

Since every successful business has recognized the fact that an accounting system is a valuable asset, it is time for the contractor-dealer to hold a little business session with himself and find out if his present system of accounting is doing all that it should for him. The time has passed when a man who carries his office under his hat and banks in his hip pocket can secure the credit which is essential to modern business. The average contractor-dealer has graduated from the class of curbstoners and has established himself as a legitimate business man, and if he is to make a success as a contractor or as a merchant of electrical wares he must know exactly where he stands financially. To do this he must have more than simply a cash book and a ledger on his desk. He must establish or buy a system of classified accounts so that he may determine the exact cost of handling each kind of appliances, and so that he may know what lines he

Educating the Manufacturer

Accounting Systems

should push to get the greatest profit out of his business. While any accounting system is better than no system at all, there is a standard accounting system that has been especially designed to meet the need of the electrical contractor-dealer and is put out by the national association. The contractor should keep exact costs on each type of construction work so that he can bid more intelligently and get away from guesswork which is injurious to him and to the industry.

A recent questionnaire sent out to get the data on the cost of handling motors divulged the fact that the majority of the dealers who handled this type of electrical goods did not know what it cost them to do business. Some of these same dealers complained that they were unable to secure credit at the banks. The answer to this is obvious. If those dealers had known exactly what it cost them to do business there is no doubt that their bank would have been willing to extend them a liberal credit.

A good accounting system is often the stepping-stone to better business and has many times turned a merchant from failure to success. It is the best little efficiency engineer that it is possible to have in a business for it shows up the leaks, the waste and the useless expenditures. It shows the profitable lines of business and those lines which are slow. It acts as a buying guide and will offer many suggestions for seasonal advertising. It is the one thing that can make the red ink on the ledger turn black.

Changing Values

The need of a different system of rate fixing is clearly shown by the recent increase in the price of fuel oil, following as it did the effective increase in rates allowed a large Western power company by just two days. On the basis of an increase in the price of fuel oil in the early part of this year most of the California power companies applied to the commission for an increase in rates. This increase was allowed by the commission to insure the power companies a reasonable surplus over increased operating expenses, and now that another unexpected increase in operating expenses has occurred the power companies are faced with the alternative of either losing the fair margin of profit which the commission has claimed they are entitled to, or going to the expense of making another application for a further increase. If they adopt the latter procedure there is no assurance that when it is

granted there will not be a still greater increase in the cost of oil that will make another increase in rates necessary.

A flexible system that would permit a sliding rate scale that would at all times allow a fair margin of profit over operating expenses would be a great help to the power companies in these days of changing values. When the peak of high prices has been reached and the price of labor and commodities begins to reach a normal plane, such a system would protect the public from excess prices for power and light. Several schemes have been suggested for accomplishing this purpose and at this time it would be an excellent idea to investigate these more thoroughly with the idea of changing the present unsatisfactory system of rate fixing.

Economies in Joint Operation

A recent compilation of western data on electric generation was worked out upon information furnished by the respective power companies. Anticipated loads for the next decade and the construction which would be necessary to meet them were being determined and the figures near completion when it was discovered that two of the companies which had been reckoned in separately had within that period joined forces and that their peak loads and requirements must be figured on a joint basis. The figure of saving ran into the millions—this irrespective of the fact that the two companies had for some time been exchanging current to ease each other's peaks.

It is only when some such concrete instance brings figures to the attention, that one realizes the magnitude of possible savings involved. Commissioner E. O. Edgerton of the California Railroad Commission in one of his recent addresses suggested the eventual possibility of all companies within a state combining in the interest of economical service. At the present time, the subject is a purely academic one, but it is not foreign to the spirit of the West, which already is distinguished by the size of the companies which serve it and by the cooperation and interconnection of these several units for the public benefit. Undoubtedly such a single corporation would have drawbacks as well as advantages, but it is to the credit of the electrical industry that it is not afraid to discuss its possibility in the light, not of the officials who might lose positions, but of the consumer's welfare.

The Tired Business Man

appreciates almost as much as his wife does, the restfulness of a smoothly-working household, free from drudgery and from the eternal servant problem.

The August 15th issue of the Journal of Electricity will feature

The Electrical Home

and will show how adequate wiring, proper illumination, and electrical labor-saving devices are increasing beauty and leisure in the modern home.

Technical Training

(What emphasis do the universities lay upon their engineering departments? Have they enough teachers, adequate equipment, a satisfactory curriculum? Are more students demanding engineering training than formerly, and are they getting what they want? These and other questions are taken up in the following article, compiled from data received from various educational institutions throughout the country.—The Editor.)

In order to gather together information as to the present status of training being given to students in engineering courses in the universities of the nation, inquiry was made of a number of representative universities in the country concerning their enrollment of faculty and students in the various engineering colleges. As a correlated subject, an inquiry was made of a number of prominent engineers and executives in the West to determine their attitude toward the training usually received in university courses.

As the progress of the electrical industry demands the turning out of thousands of young men to fill the positions of engineers and executives in the manufacturing concerns and power development companies, it is fundamentally important that these men receive the best possible training for the courses they will pursue in after life. Some of them are receiving this at the present time, but others are not. In some cases the lack of proper training is due to a lack of proper foresight on the part of the student himself; in others the courses as laid out by the various colleges and universities are not best suited to his needs; while in yet others, while taking the proper course, he does not receive the fullest possible returns from the time invested, due to the lack of university facilities, either of faculty or equipment.

Specialized Technical Work

The indications are that the universities of the country generally are so arranging their engineering curricula as to give the student those studies which are now proving to be most desirable. In some cases, colleges, particularly technological colleges, are confining themselves to the strictly technical subjects, and this is, of course, desirable as there is a necessity for a certain percentage of the graduate engineers to be highly versed in the more theoretical branches of their profession. This training will fit them to become research engineers or designing engineers.

The field of the research engineer is rapidly growing. Perhaps it is not untruthful to say that there would today be less foundation for the remark made fifty years ago by a certain official in the patent office, to the effect that he thought it necessary to resign from the patent office as he felt that there was nothing left to be invented. A most casual survey of the progress and development in electrical apparatus and applications during the past ten years will prove beyond doubt that the development of electrical apparatus is far from reaching the knee of the saturation curve. In all branches of the art, whether it be generation of power, its transmission, distribution or the transmission of speech or signals by wire or through the air, boundless possibilities are presented for the ingenious inventor and the thoughtful research man.

A peculiar type of mind is required to devote a life to research or development work. Great patience and the ability to concentrate for long periods of time on one subject are the fundamental requirements, and the training of men for such work is the duty of the technological college.

Lack of Funds in Universities

Students who are taking or preparing to take courses in colleges or universities not thoroughly equipped with the necessary laboratory and field apparatus, or having insufficient faculty to care for the students enrolled, are confronted with a matter of economics. The only apparent reason why a university or a college does not equip its laboratories with all the apparatus conceivable for the training of its students, or which does not employ enough or the proper kind of professors and instructors, is one of finance.

Privately supported institutions such as denominational colleges and those receiving their incomes from tuition fees are in a somewhat better position than state institutions in that they are not limited by law to a certain fixed income, and their finances may be augmented by further contributions from their supporters or through increases in the tuition fees. The latter course might result in a decrease in the number enrolled, which so far as that one institution was concerned would be beneficial in that it would reduce the enrollment to a point where the equipment on hand and the faculty in attendance would be sufficient to care properly for their needs.

State institutions depending upon their income from the state taxes are, during recent months, making progress in the matter of having their income increased. For example, the University of Oregon has just recently succeeded in obtaining the passage of state legislation which will increase the tax rate for raising money for its support. At the present time the Alumni Association of the University of California is very active in behalf of a measure which will increase the income of that university by some \$2,000,000 per annum. With such increases in their income, proved to be so gravely needed, these state institutions will find themselves upon a firm foundation, and thereby be able to maintain their logical places among the educational institutions of the country.

Proportion of Faculty and Students

The tabulations given showing the number in the faculty and the number of students enrolled in fifteen universities is of very general interest.

An inspection of this table shows that Colorado Agricultural College and the University of Utah have respectively 2.7 and 4.7 students per faculty member, but as these figures refer only to Junior and Senior students as stated, they are slightly mislead-

UNIVERSITY	Electrical Engineering						Mechan. Engineering		Mining Engineering		Civil Engineering		Totals, Engineering Departments		Approx. No. Engineering Students per Teacher
	Faculty	Students	Faculty	Students	Faculty	Students	Faculty	Students	Faculty	Students	Faculty	Students	Faculty	Students	
Colorado Agricultural College	97	1280	2	†5	5	†5	0				2	†15	9	†25	†2.7
University of Utah	145	1825	3	†16	3	†14	1	†12			5	†15	12	†57	†4.7
University of Pennsylvania	827	10324	9	150	28	164					20	196	57	510	8.9
University of Southern California	300	4280											8	75	9.3
University of Idaho	90	995	2	32	3	20					3	27	8	79	9.8
Stanford University	370	2132	4	4	13	215	5	5			5	80	27	304	11.2
Carnegie Institute of Technology	304	4060	6	84	6	119	7	55			6	79	25	337	13.5
State College of Washington	172	2532	3	135	10	82	2	26			4	38	19	281	14.8
Montana State College	68	1225	2	96	5	31					3	32	10	159	15.9
Rose Polytechnic Institute	16	237	3	65	3	64					3	29	9	158	17.5
University of Washington	216	7135	6	287	5	125	3	100			19	125	31	637	20.5
Purdue University	226	2955	11	463	14	589					12	350	37	1402	37.9
University of California	1626	116620			*14	*677	5	242			10	226	†29	1145	39.4
Georgia School of Technology	84	2209	5	400	10	390					9	165	24	955	39.8
California Institute of Technology (Throop College)	40	368	2	Data not available	4	Data not available					4	Data not available	10	Data not available	Data not available

†Juniors and Seniors only. First two years all take prerequisite course.

1. The figure in the student column includes registrants in the affiliated colleges of law and medicine. The Berkeley registration is 9882. The figure in the faculty column includes only the regular members of the faculty, it being almost impossible to include the staffs of the affiliated colleges.

*Including Electrical Engineering.

†This figure includes only the faculty members listed for the four engineering departments. The total of the figures supplied by the University was 183, but included all teachers of courses required of engineering students (i.e., mathematics, drawing, physics, chemistry, geology, mineralogy, hygiene, physical education, etc.), a body known as the "Engineering Council."

ing. Next on the list, and virtually first, comes the University of Pennsylvania with 8.9 students per faculty member, continuing in increasing rates to Georgia School of Technology, which has 39.8 students per member of the faculty, the average of the fourteen being 17.5. It is not necessary to conclude that the universities having the very least number of students per faculty member are best prepared to train their students, as other conditions may enter in which greatly affect the conclusion. On the other hand, it should not be assumed that the universities having the highest number of students per faculty member are least prepared carefully to train their students, as these may be better equipped with apparatus than others on the list.

Increased Engineering Enrollment

Another tabulation is given which shows the rate of increase in the engineering enrollment compared with the total for the whole of the universities and the percentage increase in the engineering colleges. Of these it is interesting to note that six show a much higher rate of increase in enrollment in the engineering courses than in the universities generally, and this is a healthy indication for the electrical and allied industries. As the electrical industry is increasing in scope more rapidly than any other one industry in the country, it is only reasonable that the students preparing to take this up as a life work should increase at like ratio.

A Broader Engineering Curriculum

Within the scope of this investigation it was impossible to investigate and compare the curricula of the various colleges, as each one would require a separate consideration for itself depending upon the needs of the individual student. But in order to collect the ideas and obtain the best advice from experienced men of mature years on the best and

most advisable subjects to be pursued, the question was asked if it was found advisable for a student to take a technical course in the more restricted sense of the word, with probably ninety per cent of his time devoted to technical subjects, or to take more general courses; and if so, which courses should be recommended.

Without fail the answers to this inquiry were that the student should not confine himself to a technical course, but should obtain a broad general education along business engineering lines.

Business engineering would be defined as the study of courses relating to trade and market conditions, history, English, logic, mathematics, record keeping, and a procession of subjects directly relating to the particular branch of the industry in which the student desired to become engaged.

Engineers, particularly electrical engineers, for example, may be divided into three classes—detail engineers, such as office men, draughtsmen, and others who are required to work out technical problems

UNIVERSITY	Rate of Increase in Engineering Enrollment Compared with Total for Univ.	Per Cent Increase
California Institute of Technology (Throop College)		Normal—10%
Carnegie Institute of Technology	Much higher	1919-20—40%
Georgia School of Technology	About the same	75% in 3 years.
Montana State College	Higher	1919-20—30%
Rose Polytechnic Institute	Special increase in Mechanical Enrollment limited	
Purdue University		
Stanford University		
State College of Washington	Higher than any but Agriculture	
Univ. of California	Lower, due in part to great increase in no. of women in other depts.	33½% in 3 years
Univ. of Idaho	Higher	
Univ. of Oregon	(Pre-engineering courses only)	40% in 1 year
Univ. of Penn.	Enrollment limited	
Univ. of South. Cal.	About the same	
Univ. of Utah	About the same	1919-20—60%
Univ. of Washington	Higher	Over 100% in 5 yrs.

along the more theoretical lines; operating engineers, who are required to fill such positions as superintendencies; and engineer executives.

Of the first, those who are qualified as research engineers have all the qualifications of the class just mentioned, and others in addition. The inside engineer is required to spend his time poring over drawings and detail instruments. All large industries require men of this type, who are painstaking in detail and thorough in finish. Such engineers would not be hampered by a lack of the general college training, but could well succeed if graduating from a technological college.

The ranks of the army of superintendents and operating engineers are at the present time largely filled with men who have not had the benefit of university training, but it is conspicuously noticeable that those men who are college trained have made far greater successes in this branch of the work. These are the engineers who come into intimate contact with the operating force of the plant. They are required to supervise the efforts and direct the energies of both trained and untrained workers, and a great deal of human understanding and sound common sense is required of such engineers. It is therefore necessary that men who hold these positions should receive more general training than the inside engineers, although since their greatest experience comes through the school of hard knocks a purely technical course in college would serve as the groundwork for the training to be obtained in actual practice.

The third group is that of the executive engineers. The president, the vice-president, the general manager, or the electrical engineer or the chief engineer of a company may be an engineer executive in that he may have a technical training along the lines of the industry in which he is engaged. He must be able intelligently to discuss technical subjects with salesmen and engineers from his own or other organizations without requiring that these be translated into popular English. He must have so great a familiarity with the technical phases that he can readily absorb the essence of any given proposition without study of the minor details.

In this classification are found the most successful engineers, both from a financial standpoint as well as that of responsible positions, and it is these engineers who require the most thorough business engineering training. Not only must an engineer executive be familiar with technical problems, but he must also deal with market and financial conditions; he must be familiar with the law, so that he is able to draw up or readily understand a legal contract; he will probably be responsible for the purchase of large volumes of material and must be familiar with metals, fabrics and processes which enter into the manufacture or production of the materials utilized.

Other work of the engineer executive is to gather from his subordinates, such as the operating engineers and the inside engineers, the various factors which enter into the solution of a given problem, to digest these and prepare them in such a form as

to make them presentable to a board of directors or higher official not versed in the technical phases of the subject. It is therefore necessary that the engineer executive be able to place the most complex technical subject in simple terms, understandable by the non-technical man. To do this requires a study of English, and for such a man it would be better to specialize on general cultural subjects, including the various college courses classified under the general head of English courses, equally with the study of the technical subjects themselves.

Taking as an example one particular branch of the college training which an engineer receives, such as mathematics, and noting its application by the three classes above: the inside man is quite likely to require the use of a great deal of mathematics, and although ninety per cent of his work will be done by arithmetic, now and then it is necessary for him to make use of higher mathematics such as differential and integral calculus; in machine design a great use is made of mathematics. The operating engineer has little need of mathematics. Generally speaking, an operating engineer may do all his mathematics on a slide rule unless his company is of such a small size as to require him to step into the branches of inside engineering as well as executive engineering. The executive engineer has perhaps the least use for the higher branches of mathematics of any of the three classes. One reason for this is that an engineer of this class is in position where it would be useless for him to spend his time performing mathematical feats when a small-salaried man could do equally well.

It is obvious, then, that the qualifications for an engineering career vary widely with the type of engineering finally taken up. As this is frequently a matter of opportunity, of mere chance, or of tastes developed after considerable practical experience, it is safe to say that a well-balanced technical, business and cultural course is the best preparation the university can offer its engineering students.

HYDRO USED FOR TREATING POLES

In a recent article published in the Bulletin of the Ontario Hydro-Electric Power Commission, E. C. Adsett, local manager of the Hydro-Electric Power Commission of Trenton, told how the heating of small wood preserving plants a l'electric instead of by an open wood fire has proved an economy both in labor and in preservative. This is due largely to the low fire risk of the electric element. The practice of brush-treating or spraying poles with hot preservative undoubtedly would be more general today but for the difficulties and risks involved in the heating of the highly inflammable hydro-carbon wood preservatives in a pole yard with no proper facilities for doing such work.

Using the electric element there are the additional advantages that the liquid is kept free from ashes, the apparatus is always ready for immediate use, and no attendant is required to devote all his time to watching the fire. To be most economical, of course, the power should be used "off peak."

The Engineer in the Making

(The engineer is destined to be one of the most important factors in human progress, and it is to the universities that the world is looking for engineers fitted to take the important places awaiting them. Is the engineer's training sufficiently broad? Is it too "practical" or not practical enough? The following symposium gives some interesting ideas on the subject as it is viewed by university-trained engineers.—The Editor.)

What does the university graduate think of the engineering training he received in college? Did it meet his needs when he began to apply it? Does a college education justify itself practically or otherwise? What does the student actually want from college and what does he get? The answers to these and other questions of the same type are of immense importance to the engineer, to the electrical industry, and to the community as a whole.

With a view to obtaining some kind of data on the subject, the Journal of Electricity sent out three questions to a number of college-trained engineers, and received several interesting replies.

More Culture for the Engineer

Almost unanimously these men deplored the lack of general cultural training among engineering students; their inability to write clear and convincing English; their deficient knowledge of history, economics and, in fact, all branches of learning not directly connected with their technical work. In some cases this is considered a result of laxity on the part of the student; in others it is attributed to the nature of the college engineering requirements, which neither include the cultural courses, nor allow the student sufficient leeway to select them for himself.

O. B. Coldwell, second vice-president of the Portland Railway Light & Power Company, writes as follows:

"After all has been said and written on the subject, it will still depend upon the student himself as to what he will get out of his college work.

"In my opinion, the general run of engineering students is if anything a little shy on general culture. In other words, their knowledge of English, history, art and other subjects of the sort is hardly broad enough; I am thinking more particularly of the English. The tendency of the engineering student is often not to take seriously his work in English, with the result that when he gets out into practice, he is unable to write a report in a manner which carries with it the conviction which is usually needed definitely to settle anything. I have come in contact with a large number of engineering graduates and I have found the above to be one of the principal handicaps under which they labor."

In much the same vein Charles W. Merrill, prominent San Francisco metallurgist, writes:

"While contact with business affairs of the world is of importance to the student, I do not feel that it is vital, although I am in full sympathy with a broader university training in the scientific courses than is usually given at a university. Particularly do I believe that economics, history and philosophy might to some extent displace the so-called practical applications, such as drilling a block of granite."

The Commercial Engineer

Another criticism of university training centers around the specialization in highly technical subjects to the utter exclusion of the business side of engineering. J. B. Black, general sales manager for the Great Western Power Company of California, voices this criticism in the following terms:

"I feel today, and have always felt, that too much time is spent in the engineering courses in the university on highly technical subjects which compared with the time they require, are very little, if any, use to the graduate who may be engaged in practical engineering.

For the man who proposes to engage in purely technical activities or research work after graduation, these courses are no doubt quite important. But for the man who takes up any of the various forms of practical engineering or construction work in my opinion they prove of very little use.

Greater emphasis should be placed upon courses in English, economics, banking, business law and practical accounting. As you know, in the ordinary four-year engineering course in the university, very few electives are given and there is a natural tendency for the student to choose the so-called "snap" courses on account of the fact that he usually has about all the work he can take care of in the prescribed courses.

I realize, of course, that it is necessary for any man in engineering activity, to have a thorough groundwork in physics, mathematics, etc., and believe further, that there is nothing quite so effective in fixing principles in a student's mind as viewing or working out practical illustrations.

I have been struck particularly by the utter lack of knowledge of ordinary business problems on the part of the engineering graduate. It seems to me that there is a great opportunity not only in public utility business, but in other lines of engineering endeavor, for the type of man who might be called a commercial engineer.

I have three alternative changes to suggest by which the engineering student may be able to acquire, or at least be thrown in position to acquire, something besides the "bare bones" of an engineering training in the university.

FIRST: Require that the engineering student finish in the high schools, a large part of the work now given in the first year or two at the university. This would release a considerable amount of time in the four-year course which could profitably be devoted to languages, finance and ordinary business education.

SECOND: Do away with the present four-year course and insist on a five-year course which would accomplish the same end as regards the obtaining of increase in time.

THIRD: Set up an entirely new course along the lines of commercial engineering, cutting out all highly technical subjects and prescribing courses in languages, finance and general business education. The present engineering course could be readjusted to take care of students who desire to follow research work, etc. This latter course should be arranged to permit of lectures by men drafted from the business world and should be supplemented by trips to various offices, power plants, construction projects, and so forth."

S. Waldo Coleman of the Coast Counties Gas & Electric Company is another advocate of a broader basis for engineering training:

"In considering the proper curricula in an engineering course it is well first to consider what we expect of the student when he graduates. He has been educated largely at the expense of the state and we should, first of all, expect that he will be a good citizen, and in the university there should have been instilled in his mind a sense of responsibility and a feeling that he should aid in the maintenance and development of a lawful government. The people of the state have a right to expect that in view of his education he shall take the initiative in constructive citizenship.

What we require today are men who THINK, are able to make practical recommendations and know how to accomplish practical things. An engineer to do this must, of necessity, have a thorough grounding in the fundamentals of his profession. He should be able to express himself well in the English language and for his recommendations to be practical (commercially possible of fulfillment) he should have an understanding of general economics, and an idea, even though faint, of banking and business law. Therefore, if necessary, we should even curtail on some of the engineering work, that the student have time to grasp points connected with English, economics, banking and business law.

"Science today, even that connected with any one branch of the engineering profession, is so vast that it is questionable whether highly specialized work in any branch should be attempted during the four-year course. Those who desire to

specialize should be encouraged to take a post-graduate course. If it is considered that the student cannot afford to spend another year at the university, this specialization should be left anyway to the senior year."

Practical Experience

The contention that the university graduate has a purely academic training behind him, and that he is virtually useless until he has had practical experience in the business and scientific world, has led many to consider the possibility of combining college work with outside experience, or at least bringing them into closer contact. In general this idea does not seem to meet with unqualified enthusiasm, Mr. Charles Merrill stating, as quoted above, that the contact does not seem to be vital, adding, however, that "A very short business course, possibly one hour a week for one semester, with a few addresses by prominent business men" would perhaps accomplish the necessary contact.

In the belief that some kind of contact should be maintained between academic and practical work, Mr. Coleman makes the following suggestions:

"Students should be encouraged to work during their vacations in industries for which they are perfecting themselves. It would be well that visits of the students, under the guidance of a professor, be made to industrial plants and public work in the immediate vicinity of the college, and that men noted in their professions be invited to address the students from time to time."

Considering the possibility of combining academic and practical training, C. R. Weymouth, chief engineer for C. C. Moore & Co., writes:

"There is no practical manner which occurs to me of solving this problem. Generally the average student, who is working his way through college, must utilize his vacation for the purpose of deriving the maximum amount of income. Practical work in engineering lines would yield a comparatively small income to the average student before graduation. Those who are fortunate enough to be able to find work in shops, in drawing rooms, or in the field, should do so to the extent that is practicable, but on the whole I think comparatively little can be done with a student until after graduation."

A letter which gives a comprehensive summary of a graduate's views, comes from G. E. Quinan, chief electrical engineer for the Puget Sound Power & Light Company:

"If the engineering graduate is to be something more than a juggler of formulæ and a computer of values; if he is to have equal opportunity with his fellow collegians from the so-called general culture college for active participation in the affairs of life, he must have, in addition to his special training in the fundamentals of engineering, a substantial grounding in the art of self expression and the science of modern business.

In order of relative importance I would place mastery of English first, knowledge of business second and technical training last. The first two are prerequisites to success in any line of work. They are fundamental and indispensable.

By mastery of English I mean the ability to express thought rapidly and clearly—the facile and effective use of language. This can come only from acquaintance with English literature and experience in speaking and writing.

There is general and just criticism of the deficiency of engineers in this respect, and this one lack, perhaps more than anything else, accounts for the failure of engineers as a class to function actively in public life. The engineer is more handicapped by lack of language than other men, because the subject of his thought is often more difficult of expression, requiring a nicer use of words and frequent resort to figures of speech and to analogy.

By no possible process of reasoning can it be concluded that the engineer will have less need of language than men in other professions, and still the engineering curricula of many colleges provide no training in English.

Of almost equal importance is a good working knowledge of the science of business. Business and life today are

almost synonymous. They are inseparably intertwined and are mutually interdependent. While engineering has long depended upon business for its fruition, the relation between the two has become so close, that it is clear upon the briefest reflection that business could not exist today without engineering. Not only is engineering vitally necessary to business and our every day life, but it is predominantly so.

With the facts as they are it may well be asked why the engineer is so seldom found at the head of a large business enterprise, and I am convinced that the answer is, lack of training. The curriculum of the engineering college not only provides no business training, but its exactions upon the student's time are so great as to make difficult the gaining of such training, even if its need were appreciated.

By business training I mean a well planned course of reading and lectures on the science of modern business. Prominent among the subjects in such a course should be the economics of business, organization and administration, accounting methods, banking practice and commercial law. The object of the course should be to give the student a working knowledge of business as it is, and not what various theorists would like to make it. The mechanism and established principles of business should be presented with an avoidance of gossamer theories and dogmatic preachments.

While I would rate technical training third in order of importance, it is on the principle that the omission of any essential endangers all. With regard to technical subjects, the engineering curricula today must be criticised for including in the undergraduate course, too much, rather than too little. Let the B.S. degree signify a thorough grounding in principles, and shape the course to that end, leaving the more highly specialized work for postgraduate study, either in the university or in the field. Though one man in twenty may come through a system of forcing, with valuable specialized knowledge and still retain a healthy body and level head, the remaining nineteen are likely to be minus all three. If the university will send out its engineering graduates really equipped in fundamentals, the engineers, her alumni, will rise up in future years and 'call her blessed.'"

Cooperation of College and Industry

The professor's viewpoint, based on long experience with engineers in the making, while approving the opportunities for practical experience, emphasizes the university's special function of teaching broad and accurate thinking, as distinguished from the facts acquired by experience. Joseph F. Merrill, Director of the School of Mines and Engineering at the University of Utah, writes:

"How, and in what, should an engineer be trained?"

No specific answer to this question can be given. Tastes, abilities, circumstances, etc., differ widely. A first-class training for Jones may be sadly deficient for Smith.

The problem of engineering education has been, and is, much discussed. Some little advance undoubtedly has been made, but has not progress been much retarded by a failure to recognize the truth stated in the first paragraph above?

There is general agreement on the proposition that the engineering college should place emphasis on fundamentals. But what are the fundamentals? Are they the same for chemicals, civils, electricals, miners, etc.? Here is where agreement is sadly lacking.

But on one proposition there is general agreement, viz.: the colleges have their limitations. Practical training can be more thoroughly obtained on the job than it can be in college. The college has its shops, laboratories and fields, to be sure, and these are necessary for training in fundamentals; but they can never replace the shops and fields of industry as practical training schools in industry. Hence, when a really practical training is wanted along with a college training, it is found that the best thing is for the college and the industry to cooperate.

But whether formal cooperation, as now arranged by some Eastern engineering schools, exists or not, the fact is that some cooperation in the training of engineers does exist between all engineering schools and industry. Engineering students spend their vacations working in the industries, and this vacation work is an important factor in their training.

What kind of course should an engineering college give? What should its content be? Briefly, the course should stress fundamentals, i. e., the basic principles of engineering science,

and leave the details of highly specialized application to graduate or field study. The content should include considerable English, especially composition, speaking and technical writing, cost accounting, business organization and management, industrial relations, business law and current events.

The best that the engineering college can do for its students is to train them to think accurately and to become intelligent with respect to the world in which they live, especially with respect to that field in which they will serve. Possessed of the ability to think and to work, the young engineer has success in his keeping, provided he has learned to live and work agreeably with others."

A great deal more might be said on the subject of technical education, but the incomplete data at hand seems to be in agreement on several important

points. While many graduates have specific ideas concerning changes which might be made in the university curriculum, there is a general sentiment in favor of broader culture for the engineer, and also of a recognition of the needs of the non-technical engineer.

Behind the specific criticisms and suggestions, there is an underlying sentiment which recognizes in the university course an intrinsic worth distinct from its so-called "practical" value, appreciating it as a training in habits of thought and study which are fundamentally more important than an accumulation of facts.

The Education of an Engineer

BY R. W. SORENSEN

(The materials of progress and the demands upon technical men are added to or changed with every new discovery. The familiarity with the tools of science, coupled with clear thinking, a broad outlook and considerable general culture must be the basis of the engineer's education is one of the main thoughts brought out in the following article. The author is professor of electrical engineering at the California Institute of Technology.—The Editor.)

Everyone is of necessity interested in some form of technical education. A score of years ago only a high grade engineer could run a gas engine. Now laws must be passed to keep children from driving high-powered automobiles. Two or three decades back a few men of magical ability installed electric lights, repaired electric bells, or talked over a telephone. Today every housewife speaks glibly of ignition systems, spark plugs, batteries, volts, amperes and kilowatts while she makes a necessary repair to a stalled auto along the road, changes a broken iron or toaster cord, or puts a new set of fuses in the cut out.

A generation back, when these things were new, technical colleges were established to teach men the new sciences and their uses, and to inspire them with a desire to search beyond the then known discoveries for ones of even greater value. Annihilation of time and space, on the land, in the air, and under the sea, and cost reduction of life's comforts and necessities are the proof of the pudding. The technical college of our fathers has justified itself, and its works stand as a monument to the romance of our present civilization. The work of father's technical college was after all not so different from that of the other departments of the university, because the small number of technical fundamentals developed and the dearth of adequate technical text books made it necessary to give the scientific student a goodly portion of the orthodox university work if his time was to be properly occupied.

New discoveries have been made one after another, men of science have specialized and become teachers. These teachers love both their work and their students, and have a desire to give to the student the best possible knowledge of the subject being taught. Many of the early scientific laws developed have stood the test and have not been replaced by new discoveries. To obtain time to learn all of these things, what could be more natural than the introduction of more technical courses into our college

curriculum to the detriment and elimination of the non-technical courses?

This practice produced, without question, a superior technician, other things being equal, than did the old school. Living as he has at a time such as has just passed, the technical man has frequently been allowed to detach himself from the things of world interest along other lines to such an extent as to cause him real embarrassment at times. This only seemed to make the situation more acute and to cause too many scientific and technical men to serve only where they find a ready welcome for the language of the slide rule and the mathematical equation. In spite of these handicaps today's technical man has met and stood the test.

Those whose business it is to serve as educators in our colleges are earnestly confronted with such questions as these:

1. Is a technical education worth while?
2. Are our technical colleges using the students' time to best advantage in conducting the courses selected?
3. Are the courses provided for in the curriculum such as to give the most advantageous use of the time of the majority of the students in a given course?
4. Should the course be arranged so as to produce skilled artisans in the several professions or should it produce men versed in theory only?
5. Should more than four years of a man's time be devoted to his college work?
6. Are the problems of the technical man of the future to be the same as those of pre-war time, or are they to be different for each generation of mankind?
7. What high school courses give the better preparation for a technical college?

Is Technical Education Worth While?

The other day an engineer of ability and nationwide reputation said something like this: "Do you know, I think it would be disloyal of me to express my real opinion of engineering as a profession, because it seems to me that from now on, if a technical man is to succeed, he must use his technical knowledge in other lines of business." Some of us know that years ago a patent examiner left the Patent Bureau of the United States Government because he

said "everything had been invented." The world never needed technical inventions as it does today. We are looking for an electric motor that won't burn up, a way to get more than two gallons of fuel for the automobile at one time, a storage battery comparable in performance with other devices, and other improvements too numerous to mention. The whole world is crying for a scientist to give us not only these things but many other devices, and there is no limit except a man's ability to the things he may yet do in the realm of scientific research and invention.

By these tokens our friend was absolutely wrong. Also he was right, for even greater than these problems are some of the problems of social, commercial, and industrial reorganization which must be solved. There is every reason to believe that in these problems the engineer should be foremost. He is trained to analyze and get at the truth by means of cold scientific facts. He has learned that if his analysis of these facts is not correct, he must forever live in the shadow of an enduring monument of concrete or steel, to which the people refer as "an engineer's mistake." The engineer has erred in setting up limitations which have kept him out of this kind of service, but these limitations may all be remedied and the prophecy of our friend will be in part true because some of the great technical minds of the world will be called upon to solve these problems, which even though considered non-technical are none the less susceptible of solution by technical methods. In other words, the war has done much to teach the technical man that technical facts may be presented in languages other than those of the equation and slide rule, and knowing this, he is going to find ways to express his knowledge in these other languages which are better understood by the world in general.

The College Curriculum

There are many things which affect the curriculum of colleges, not the least of which is geographical location, and in all probability no one technical curriculum which would be best for all technical colleges could be selected. It is the opinion of many of our industrial engineers and foremost educators that there has been a tendency to spend too much of the student's time in teaching special subjects and trade tricks, with a corresponding dearth of time allowed for the study of history, English, economics, and other such general studies which every educated man must know something of if he is to find the better ways of applying his technical knowledge.

It is the opinion of the author that our technical colleges should not produce skilled artisans, but should rather produce men well grounded in their knowledge of the fundamentals of science and its application and imbued with the idea of research, rather than perfection of operation. These colleges should be supplemented by institutions in which the skilled artisan may be developed.

Four years seems to be the popular time allotted to a young man's technical education as conducted at present, but there is a far greater call for men

who have spent the additional time required for a Master of Sciences degree, than can be filled at the present time. Men who show ability to handle advanced scientific work, particularly of a research nature, should be encouraged to devote five or even six and seven years in getting a thorough preparation to undertake larger scientific problems. On the other hand, the success of the four years technical course has been so well demonstrated as to warrant an entry of the man who has completed one of these courses, into the active industries.

The problems of the technical man of the future are to involve very much the same fundamentals as those of the past and those of the present time, but just as today's problems of radio, automobiles, air craft, etc., are different from the problems of the development of the Morse telegraph, the steam engine, and the locomotive, so will the future problems be different from today's. The man who knows scientific fundamentals, rather than scientific art-craft, and then in turn knows how to tell them to those who do not know them, will, when these changes come about, find it easier to adjust his life to the changes and thereby be of greatest service to mankind.

Summary of Essentials

In conclusion, then, it may be said that the essentials of a technical education are:

- The establishment of a set of high ideals and moral and religious standards.
- A knowledge of men, and an understanding of the things which make up the life of non-technical humanity.
- A mastery of the English language.
- A thorough knowledge of scientific and technical fundamentals.
- A knowledge of engineering methods.
- When all these are said and done we have an engineer.
- "An engineer is one who economically directs manpower, and by scientific design, uses the forces and materials of nature for the benefit of mankind."

Appendix

California Institute of Technology is an example of those institutions which recognized the change in times as soon as the war was over, and appointed a committee to determine upon its curricula for the future. This committee worked hard on the matter for almost a year during which time weekly meetings were held. Advice was sought of the advisory council of the college: John J. Carty, vice-president, American Telegraph and Telephone Company; Gano Dunn, president, J. G. White Corporation; Frank B. Jewett, chief engineer, Western Electric Company; John C. Merriam, dean of the faculties, University of California; Charles L. Reese, chemical director, E. I. DuPont de Nemours and Company, and other men of the technical profession. The first striking action of the committee was the elimination of the modern language from the required course of every engineering student. This change does not make it impossible for a student to get the languages if desired, but it relieves a large portion of the student body free to devote their time to other things. These other things, however, must be of the general studies mentioned, rather than the technical subjects, more time being required for English, history and current topics in particular. Each other subject was taken up for discussion and its value weighed as compared to all other subjects desirable and the curriculum made up as seemed best to the committee. As a result of this work the time of the course was divided as in Column "A" of the following table. For purposes of comparison, in Column "B" there is given a table in which is shown a division of time as determined by averaging the time devoted to these subjects in twenty-five of the leading technical colleges of the United States.

PER CENT OF COLLEGE TIME

Subject	A		B	
	California Institute of Technology		Average Twenty-five Technical Colleges	
Mathematics	15.10		15	
Physics and Chemistry	12.10	27.20	12	27.00
English and General Subjects	16.90	(English and languages)		
Economics and Business	4.35			8.00
Mechanics and Hydraulics	9.00			4.00
Freshman and Machine Drawing	4.45			10.00
Engineer Subjects	38.00			5.00
				45.00

In addition to the regular academic work each student at California Institute of Technology is required to take three hours of physical education work under a competent director.



DELEGATES AT THE PACIFIC COAST CONVENTION

A. I. E. E. Convention at Portland

(This report of the largest A. I. E. E. convention ever held on the Pacific Coast is rich with accounts of discussions which took place on such timely subjects as the design of suspension insulators, hogged fuel, railroad electrification and the power factor correction on distribution systems. A brief account of the sporting activities as well as the entire convention registration list follow the discussion reports.—The Editor.)

Vice-President J. B. Fiskien called the Ninth Annual Pacific Coast Convention of the American Institute of Electrical Engineers to order July 21, at the Multnomah Hotel, Portland. The meeting opened with an attendance of in excess of one hundred and fifty which was greater than any of the former Pacific Coast conventions. In the absence of President Townley, Mr. Fiskien presided during the convention. Mayor Baker of Portland extended a brief welcome to the delegates and urged that they lend their fullest cooperation to the development of the water powers of the West.

Vice-President Fiskien urged that greater efforts be made to point out the benefits that engineers gained by attending the Institute conventions. The public utilities are prone to support other organizations dealing more with commercial subjects than such organizations as the Institute which are for the benefit of the engineers. One reason that such is the case is that the engineers have not maintained their rights.

Secretary F. L. Hutchinson announced that Mr. Fiskien has accepted the chairmanship of the sections committee for the coming year, and will therefore continue to exercise a great influence upon the progress of the Institute.

Vice-President-elect Magnusson recalled the fact that this was the centennial of some of the most important steps in electrical history, including the work of Colta, Ohm, Faraday and Henry, who were with one exception university professors. Since that date there has been a decided change in research work and at present it is the exception when a discovery is made within a university, the more important discoveries and developments having been made by the research departments of the large manufacturing plants. Mr. Magnusson was of the opinion

that large manufacturing industries could not live without industrial research and manufacturing would not grow without it, therefore since the Pacific Coast is doing little in the way of industrial research, manufacturing industries here will not make the same strides as in the East where the many well known research laboratories are located.

The insulator papers by Peaslee, by Ryan and Henline, and by Peek were read and later discussed together. A part of the first is quoted below.

FACTORS CONTROLLING THE DESIGN AND SELECTION OF SUSPENSION INSULATORS

BY W. D. A. PEASLEE

In the early days of electrical distribution of power the insulator problem was unimportant. The insulator gave more satisfactory service than the rest of the apparatus essential to the generation and distribution systems. As the transmission distances and therefore the economic transmission line voltages increased the insulator problem became more acute. The first attempt to meet the insulation requirements of these higher voltage lines was an increase in the physical dimensions of the lower voltage type of unit. No attention was given at this time to the distribution of the dielectric field or its shape although the laws governing the dielectric flux distribution in such cases were well-known.

The conventional type suspension insulator unit, and also, to some extent, the multi-shell pin type unit, seem in general to be subjected to the types of failures indicated in the following table:

Mechanical Failures

a. Due to the use of materials having widely different coefficients of cubical expansion as in conventional cap and pin construction which causes enormous stress under temperature changes.

b. Due to mechanical overloading.



OF THE A. I. E. E. HELD IN PORTLAND, JULY 21, 24

- c. Due to shocks as shooting.
- d. Due to lightning and power arcs.

Electrical Failures

- a. Actual electrical puncture.
- b. Leakage under adverse conditions followed by flash-over and heavy power arc.
- c. Due to porosity.

The requirements to be met in the design of suspension insulators may be broadly classed under two headings:

1. The insulator must support the line mechanically with adequate safety factors under the most adverse conditions.

The insulator must insulate the line with adequate safety factors under any electrical conditions not rendering other apparatus on the line inoperative.

The insulator situation today is in a state of constant development and considerable progress may be expected in the near future. Certain recent investigations indicate that piezo-electric effects may be of considerable influence in porcelain depreciation and recent developments indicate that this situation will soon be met in a very satisfactory manner. Also some rather interesting work is being done at present on the solubility of porcelain in water under the conditions existing in the capillary passages connecting the voids of porous porcelain. Investigations are under way using pressures around 10,000 lb. per sq. in. with very high and very low temperatures to accelerate this action and, by means of the microscope, determine from samples of porous porcelain that have depreciated in the field compared with the porcelain subjected to accelerated tests in this manner, to what extent this solubility may be responsible for increasing porosity. The problem of very high-voltage transmission systems is being studied and some new types of insulators made up of rather special porcelain bodies are being developed that will meet this situation without difficulty, and by the time there is money available to build any of the large projected extremely high-voltage lines, insulator manufacturers will be ready to meet the problem.

Insulator Deterioration

The subject of insulator deterioration was discussed from the viewpoints of the manufacturers as well as the operators. Many instances were quoted of insulators having been in service from 15 to 22 years and having had only a very small percentage of failures and in some cases no fail-

ures whatever. J. B. Fiske gave an instance of a 60-kv. line placed in operation twelve years ago constructed with aluminum conductor which was protected by exceedingly long arcing horns to avoid danger of burning the conductor in case of short circuits. Owing to the shielding effect of these antennae there have been no failures whatever due to the insulators themselves. This is perhaps the first instance of insulator grading by means of antennae shields. M. T. Crawford of the Puget Sound Power & Light Company stated that an installation of Hewlett type insulators had given no trouble due to punctures from the line voltage and only a few failures due to direct lightning strokes. In his opinion the small area of contact between the metallic link and the porcelain was not good practice. However, J. C. Clarke pointed out that the former practice of using steel links had been discontinued because of this and copper links substituted which more nearly conformed to the shape of the slot in the insulators, thereby giving a greater area of contact. Professor Ryan stated that one cause of trouble due to the condition Mr. Crawford had in mind was that the iron ionized and ions were driven into the surface of the porcelain, but that copper was not subject to this.

Shielding

Although the results noted by Ryan and Peek indicate that shielding has a very marked effect upon the reduction of the unit duty of those insulators in a string which are nearest the line, there were those who were of the opinion that an increase in the number of units would be the best solution for the insulation of lines having a voltage of 220 kv. and higher.

According to E. R. Stauffacher, of the Southern California Edison Company, the Big Creek lines will, within the next two or three years, be operated at 220 kv. The problem of line insulation is one which will be determined by field investigation of the different arrangements of insulator strings, number of units, and methods of shielding. The most feasible method of supporting the center wire which passes through the towers appears to be by means of two strings arranged in either V shape or inverted V shape. Professor Ryan will immediately proceed to investigate the various combinations possible for use on this line.

Porosity

The manufacturers' agents claim that porosity has been entirely eliminated in present day insulators. Mr. Peaslee pointed out that between firing limits of 1250° and 1450° C. porosity was reduced to zero, while above and below the values given, porosity would result. W. A. Hillebrand pointed out that porcelain is composed of three substances, quartz, feldspar and clay. In vitrification the feldspar melts and acts as a binder for the quartz, the clay being decomposed. Vitrification means that the interstices are filled by the molten feldspar—too low a temperature resulting in improper vitrification and too high a temperature causing a formation of nitrogen which caused bubbles. Satisfactory vitrification can be obtained not alone by proper temperature, but must be preceded by uniformity in the processes prior to firing. Within the last five years practically no porous insulators have been marketed.

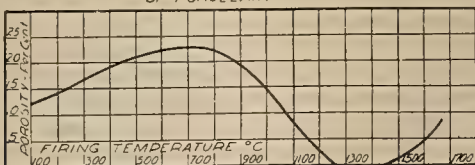
In the testing of insulators W. E. Hawley of the Locke Insulator Company stated that under a pressure of 13,000 lb.

per sq. in. no penetration of fuchsine dye could be detected by microscopic examination. Mr. Peaslee stated that efforts had been made to determine quantitatively degrees of porosity less than a few hundreds of one per cent, but that efforts had failed to give any results at these low percentage porosities.

Testing

The records of one of the Portland Railway, Light & Power Company lines were given which showed that after two years' service 12% of the units were found defective and after an additional period of six years 7% were found defective.

INFLUENCE OF FIRING TEMPERATURE ON POROSITY OF PORCELAIN



Curve illustrating results of the fuchsine method of testing porosity, which guards against any errors in raw materials or reading of the pyrometers, that might cause porosity through firing outside of the permissible range.

In these tests all insulators over 100 megohms were left on the line. The testing was done by means of a 1000-volt, 200-megohm scale megger. J. C. Clarke of the General Electric Company questioned the use of meggers such as these in that the resistance of an insulator based on the specific resistance of porcelain should range from 500,000 to 1,000,000 megohms. Professor Ryan agreed with this contention and felt that any insulator meggering less than 2,000 megohms should be replaced.

It was urged that the institute redraw their insulator specifications in order that there might be greater uniformity in the ratings of similar insulators of different manufacture.

In the specification of high frequency testing Professor Ryan showed that the frequency was of probably less effect than the interval between the impulses and the intervals should be specified as well as the frequency.

The effect of vibration upon the life of porcelain was discussed and Mr. Peaslee stated that his tests of impacts on insulators and porcelain samples running into 11,000,000 or 12,000,000 impacts had shown no effects whatever upon the porcelain structure. Providing the porcelain is not stressed to the ultimate limit there appears to be no damage done by any stresses of less magnitude, no matter how often repeated.

Since porcelain contains quartz and quartz displays a very marked piezo-electric effect there might be the likelihood that internal stresses would be developed from this effect. Professor Ryan pointed out, however, that a 1-in. cube of quartz under a tension of 500 volts expanded 1/20th of the length of a wave of sodium light. Inasmuch as a wave of sodium light has a length of 1/50,000 inch, the magnitude of the effect was too slight to cause appreciable mechanical results.

HOGGED FUEL

Discussion of Mr. Corbet's paper on hogged fuel brought out the opinion that as yet hogged fuel is not sufficiently reliable to be used exclusively. According to Mr. Merwin of Portland many interruptions of fuel supply within a plant are due to a breakage on the conveyor system, and the Northwestern Electric maintains heated oil under pressure for quick change-over which can be effected in two minutes. He stated that the oil burned in hogged fuel furnaces gives a lower efficiency than in fuel oil furnaces. The conveying of hogged fuel is usually done by chain conveyors with metallic or wooden flights, although the Northwestern Electric has had good results from belt conveyors two feet wide running three hundred feet per minute at a thirty-degree angle, with the fuel fed in a constant stream on to the belt, sixty units of 200 cu. ft. being handled per hour. Mr. Merwin expressed his conviction that hogged fuel will not ignite spontaneously although the accumulation of fine dry dust must be removed from ledges and walls. An incandescent lamp resting against a dust-covered wall had been known to start a fire.

J. H. Polhemus, general manager of the Port of Portland, stated that on a dredge hogged fuel achieved a saving of \$3,000 monthly, and that 10,000 lbs. evaporation per unit of fuel had been obtained. Seven pounds evaporation per hour per square foot heating surface was given as a good performance for hogged fuel.

Mr. Hayward pointed out the possibility of mill refuse coming to be used to produce alcohol, although Mr. Corbett

stated that the cost was too great to make it a subject for present consideration.

The opinion was expressed by Mr. Merwin and Mr. Corbet that short, straight grate bars were preferable to any others, and that no difficulty would result from distortion if sufficient supports were provided, and the ash pits flooded to reduce temperature of lower surface grates. Stokers were considered too expensive at the present prices of fuel.

Mr. Corbet maintained that moisture content was independent of climatic conditions, but was entirely dependent on the kind of wood and the treatment before hogging. Some moisture was preferable as extremely dry wood fleshed in furnaces and introduced an undesirable hazard in storage. A mixture of wet fuel with refuse from kiln dry wood gave the best firing results.

RAILROAD ELECTRIFICATION

Much of the discussion of Mr. Beeuwkes' paper centered around the question of standardization of voltage. The general opinion seemed to be that there was at present no basis for standardization. It was thought that 3000 volts was most economical for single track lines, 1500 volts for two-track lines, and for four-track lines even 150 volts. These voltages are such that doubling or quadrupling track would permit of ready cut-over of equipment for lower voltages. Statements were made to the effect that there is no real necessity for standardization between different roads, although locomotives are capable of running nearly one thousand miles without stopping. Mr. Beeuwkes stated that the cost increase in changing voltage from 3000 to 5000 would be greater than the saving of feeder copper for handling 5000 ton trains.

Opinion was unanimous that railroads should purchase power from power companies in that more feed points would be obtainable, and that the comparatively small amounts of power demanded, providing limiting devices were installed, would not be such as to cause excessive peaks on a power system of normal size. Furthermore, the diversity of a railroad load operating at approximately sixty per cent load factor would be very desirable for the power company.

It was held that transmission lines paralleling track should be owned by the railroad, Mr. Beeuwkes pointing out that trolley maintenance crews could maintain transmission lines at minimum additional expense. Mr. Pratt of the Montana Power Company agreed with this but thought the power company should pay for the value of tying their own stations together and for supply to other consumers fed from railway transmission lines. According to Hayward of Vancouver, railway transmission lines should not take the place of transmission busses.

A further argument for railway ownership of transmission lines was that control of switching is thereby retained by the railroad.

According to J. C. Clarke, some Western railroads have maintained that power companies could not accommodate swings caused by heavy trains, but as this is now proved incorrect, these railroads must proceed with electrification to conserve fuel oil.

It was stated that electrification will postpone double tracking for from ten to fifteen years, and that the interest on the second track for that period would overbalance the cost of electrification. Mr. Beeuwkes said that the expense of six months' operation of one division of the C. M. & St. P. Railroad was \$113,000 as against \$270,000 for fuel, but that any road could calculate exactly the possible savings under any given condition. Comparative costs of train and enginemen expense and wages he gave as 48,000 for electric and 85,000 for steam in six months. The repairs for steam locomotives doubled that for electric locomotives. A further reduction in costs will be effected on the C. M. & St. P. by the installation of automobile substations.

POWER FACTOR CORRECTION ON DISTRIBUTION SYSTEMS

In the discussion of the paper on this subject by D. M. Jones, the opinion was expressed that engineers and operators should encourage the use of the term reactive or inductive factor rather than power factor, as a few per cent reduction of the power factor means a great increase in reactive component. The reduction of power factor from unity to 99% gives an increase of 14% in reactive component.

In some cases power companies charge their customers for low power factor, and in others they assist the consumers to carry expense of installing synchronous motors to raise power factor. The Utah Power Company has installed many synchronous motors in low head pumping plants, and as these have simple starting arrangements they are as easy to put

(Continued on page 142)

Electric Power Consumption, C. M. & St. P. Railway

BY REINIER BEEUWKES

(The economies of railroad electrification are among its most interesting features, and the following details of the distribution and consumption of power on the electrified divisions of the Chicago, Milwaukee & St. Paul Railway provide a valuable compilation of data on the subject. The paper is one of those presented at the A. I. E. E. convention in Portland this month; its author is electrical engineer for the Chicago, Milwaukee & St. Paul Railway Co.—The Editor.)

Power for the electrical operation of the Chicago, Milwaukee & St. Paul Railway between Harlowton, Mont., and Avery, Ida., is delivered to the transmission system of the railway in the form of 100,000-volt, 3-phase, 60-cycle current, and is supplied under two separate contracts, one for the Rocky Mountain Division, extending from Harlowton to Deer Lodge, and the other for the Missoula Division, extending from Deer Lodge to Avery.

The railway transmission line of the Rocky Mountain Division extends from Two Dot substation to the Morel substation, a distance of 184 miles, the former point being 12 miles from Harlowton, the eastern terminus of the division, and the latter point 17 miles from Deer Lodge, the western terminus. Power is delivered by the power company at the Two Dot, Josephine, Piedmont, Janney and Morel substations. The railway transmission line of the Missoula Division extends from Gold Creek substation, 18½ miles from Deer Lodge, a distance of 180 miles, to the substation at Avery, the western terminus of the division.

Substation System

Seven substations on each division are used to convert the 100,000-volt alternating current of the transmission line to the 3,000-volt direct current used for traction purposes. The rated capacities of these stations are as follows:

Substations	Transformers	Motor-Generators
Rocky Mountain Division		
Two Dot	2—2500 kva.	2—2000 kw.
Loweth	2—2500 "	2—2000 "
Josephine	2—2500 "	2—2000 "
Eustis	2—2500 "	2—2000 "
Piedmont	3—1900 "	3—1500 "
Janney	3—1900 "	3—1500 "
Morel	2—2500 "	2—2000 "
Missoula Division		
Gold Creek	2—2500 kva.	2—2000 kw.
Ravenna	2—2500 "	2—2000 "
Primrose	2—2500 "	2—2000 "
Tarkio	2—2500 "	2—2000 "
Drexel	2—2500 "	2—2000 "
East Portal	3—2500 "	3—2000 "
Avery	3—1900 "	3—1500 "

There is an insulated air gap in the trolley in front of each substation separating the trolley system west of the substation from that east of the substation, that is, portions east and west of the substations are fed, respectively, through separate feeder breakers. There is also an insulated air gap at the beginning and end of every passing track, so that by means of a section switch installed in the feeder at the gap the district between any two gaps may be isolated in case of trouble so as to permit operation up to the location of the open switches.

Contract for Power Supply

The terms of the power contracts are similar, and each provides for a minimum payment on basis of a 60% load factor. Where the load factor exceeds

60%, payment is made on basis of the actual kw-hr. consumed, the rate being 5.36 miles per kw-hr. The demand is controlled for each division by means of a so-called Power Indicating and Limiting system, which, on the Rocky Mountain Division, was put into operation early in the year 1918 and on the Missoula Division a few months ago. Briefly, this system is so arranged as to indicate and record at the dispatcher's office at Deer Lodge the total kilowatts or demand being supplied in any instant by the power company to the railway company, and to prevent the maximum demand from exceeding a certain amount as determined by the "demand setting made by the dispatcher," this limiting action being secured by lowering of the substation d.c. voltage and therefore of the train speeds.

The percentage of time when the limiting action will take place will, for a given amount of business, depend on the demand setting and on the possibilities of spacing the trains so that as few as possible will at one time be operating on the heavier grades, the latter matter, except as regards passenger trains and certain time freights, being to a considerable extent in the hands of train dispatchers. The slowing up of the train speeds of course results in increased train and enginemen's expense and increased time in getting freight over the road, and a proper balance must be struck between this increased expense and the saving in power cost, determining upon the limit setting accordingly. The following tabulation will give an idea of the percentage of time the limiting action takes place with average kw. load and settings as indicated, this percentage being based on the number of hours the limiting system was actually in service.

Month	Limit Setting	Avg. Monthly Kw. Actual	Per Cent Time Limiting Action Takes Place
July, 1918	12,000	8,020	13.0
Aug., "	12,000	7,820	15.5
Sept., "	12,000	6,675	8.2
May, 1919	14,000	7,840	4.62
Aug., "	14,000	7,650	4.12
Sept., "	14,000	8,230	9.50
Oct., "	14,000	8,420	10.65
Nov., "	14,000	7,115	8.24
Feb., 1920	16,000	8,625	2.40
Mar., "	16,000	8,680	2.20
Apr., "	16,000	8,620	1.90

Power Consumption for Freight and Passenger Service

In arriving at the amounts chargeable for power against the different respective classes of train service, the total kw-hr. to be paid for, that is, the actual kw-hr. or same increased, if necessary, to correspond to a minimum 60% load factor, is taken and from it is deducted the kw-hr. metered against substation lighting, auxiliary power, signal system supply, etc., amounting to about one per cent. The remaining kw-hr. is then split against the different

Month	Thousands Gross Ton Miles Trailing	Net Kw-Hr. per Thousand Gross Ton Miles		Thousand Gross Ton Miles		Load Factor	Cost, Kw-Hr. per Thous. Trailing Gross Ton Mi., Cents
		Trailing At High Tension Bus	At Loco- motive	Trailing At High Tension Bus	At Loco- motive		
FREIGHT SERVICE:							
ROCKY MOUNTAIN DIVISION							
Jan.	98,478	47.8	36.3	41.2	31.3	63.7	25.7
Feb.	79,859	43.1	27.3	37.3	23.6	57.7	24.0
Mar.	118,297	39.0	29.3	33.9	25.5	65.3	20.9
Apr.	121,646	38.5	25.6	33.1	22.0	61.2	20.7
May	124,395	36.5	26.1	31.7	22.6	56.0	20.9
June	122,264	36.7	26.2	31.7	22.9	56.4	20.9
July	120,723	36.7	23.3	31.6	20.9	55.4	21.3
Aug.	111,092	40.9	27.2	34.9	23.2	54.6	22.4
Sept.	115,787	39.7	25.6	34.1	22.0	58.8	21.7
Oct.	108,920	45.8	29.2	39.4	25.1	60.0	23.6
Nov.	86,267	44.0	29.6	37.7	25.3	50.9	27.8
Jan.-Nov., Avgs.		40.5	27.7	34.8	23.8	57.3	22.5
MISSOULA DIVISION							
Jan.	87,598	44.3	29.9	38.6	26.1		23.8
Feb.	73,481	39.8	26.2	35.2	23.2		21.7
Mar.	103,613	40.3	25.8	35.6	22.8		21.6
Apr.	109,133	38.5	25.4	34.1	22.4		20.2
May	118,331	37.9	25.1	33.5	22.2		20.3
June	116,660	37.8	25.6	33.3	22.5		20.3
July	106,045	38.1	25.0	33.5	22.0		20.4
Aug.	101,017	38.8	24.6	34.3	21.8		20.8
Sept.	99,578	38.5	25.9	34.1	22.9		20.6
Oct.	100,504	40.0	27.1	35.3	23.9		21.4
Nov.	78,459	45.3	29.5	39.2	25.5		24.3
Jan.-Nov., Avgs.		39.7	26.3	35.0	23.1		21.3
ROCKY MOUNTAIN AND MISSOULA DIVISIONS COMBINED							
Jan.-Nov.	2,302,507	40.1	27.1	34.9	23.5		21.9
Jan.-Dec.	2,476,085						22.3
PASSENGER SERVICE:							
Jan.-Nov.	340,480	56.8	38.7	39.7	27.1		38.4
Jan.-Dec.	378,080						38.1

These figures are given merely to show the results which are at present being obtained since it is expected that considerable improvement will be effected in maintenance method which will tend to reduce costs.

classes of train service, freight, passenger and non-revenue, in proportion to the total net kw-hr. readings obtained for these respective services from wattmeters installed in the locomotives. These readings are taken by the engine crew on entering and leaving the engine on a form provided for the purpose, and a record of the power consumption of each train is thus obtained. The readings are referred to as "net" readings, as they represent motored energy less re-generated energy.

The ratio of the total net locomotive wattmeter readings, all services, to the total actual kw-hr. input to system chargeable to locomotives for the various months of 1919 and for the whole year is given below:

ROCKY MOUNTAIN DIVISION				MISSOULA DIVISION			
Month	Actual Kw-Hr. System Input for Loco's.	Net Kw-Hr. Input at Loco's.	Ratio	Actual Kw-Hr. System Input for Loco's.	Net Kw-Hr. Input at Loco's.	Ratio	
Jan.	6,381,233	4,838,480	75.9	5,540,581	3,753,430	67.6	
Feb.	4,610,607	2,921,840	63.3	4,107,960	2,702,710	65.8	
Mar.	5,795,859	4,351,126	75.2	5,412,048	3,469,120	64.2	
Apr.	5,949,840	3,962,650	66.6	5,429,932	3,574,080	65.8	
May	5,803,455	4,146,517	71.4	5,745,397	3,795,770	66.2	
June	5,662,650	4,100,810	72.3	5,697,785	3,853,590	67.6	
July	5,744,738	3,794,940	66.2	5,318,692	3,505,630	65.8	
Aug.	5,648,815	3,755,280	66.5	5,133,008	3,255,820	63.4	
Sept.	5,892,430	3,799,830	64.5	5,102,562	3,434,010	67.3	
Oct.	6,222,486	3,971,149	63.8	5,389,883	3,654,955	67.8	
Nov.	5,095,937	3,425,458	67.2	4,879,130	3,181,456	65.2	
Dec.	5,809,976	3,830,870	65.8	4,971,601	3,382,700	67.9	
	68,618,026	46,898,850	68.3	62,728,579	41,563,271	66.3	

As there are no wattmeters installed in the direct current side of the substations, a ratio for net substation output to system input or to locomotive input is not obtainable. There are, however, wattmeters in the circuits of the individual motor-generator sets, and the following table will be of

interest in showing the manner in which the energy is distributed among the respective substations, average kw. being used for convenience instead of total kw-hr., and the whole of the year 1919 being taken.

ROCKY MOUNTAIN DIVISION			MISSOULA DIVISION		
Substation	*Total Avg. Annual Kw. Input Net to Motor-Genrs.	**Per Motor-Gen. Avg. Annual Kw. Input Net to Motor-Genrs.	Substation	*Total Avg. Annual Kw. Input Net to Motor-Genrs.	**Per Motor-Gen. Avg. Annual Kw. Input Net to Motor-Genrs.
Two Dot	895	813	Gold Creek	1150	1128
Loweth	962	783	Ravenna	915	1115
Josephine	1014	1013	Primrose	908	925
Eustis	1022	1016	Tarkio	843	803
Piedmont	1218	617	Drexel	790	778
Jannet	1390	559	East Portal	1390	778
Morel	1047	1072	Avery	812	523
System			System		
Total	7548		Total	6808	

*Total kw-hr. in year; 8856 hrs. being taken, as four days in December are included.

**Total kw-hr. running hrs. of motor-generators.

The figures below show for the year 1919 the net kilowatt-hours per thousand gross ton miles for freight revenue service and passenger service, respectively, and corresponding cost of these kilowatt-hours at the high tension bus or point of delivery of the power to the railway system. The lesser consumption of energy during the summer months as compared with the winter months will be noted. The figure for the passenger service are approximate, as the ton mile data is based on the assumption of an average weight per car, no record of the particular cars handled in the separate trains being available:

1. Cost per Thousand Gross Miles trailing freight as actually distributed in accounts..... 28.8c.
 2. Cost per Thousand Gross Ton Miles train freight as actually distributed in accounts 24.9c
 3. Cost per Thousand Gross Ton Miles trailing freight on basis distribution in proportion to freight kw-hr..... 30.2c
 4. Cost per Thousand Gross Ton Miles train freight on basis distribution in proportion to freight kw-hr..... 26.2c
 5. Cost per actual kw-hr. delivered to locomotives..... 1.1c
- The above unit figures include the cost of power.

(Continued on page 145)

Problem Course in Electricity

BY H. H. BLISS

(To be able to make the simple calculations in connection with current and power is an asset even to the electrical man who is not directly concerned with the technical side of the industry. Following is the second of a series of articles aiming to cover this ground by means of practical electrical problems. The author is supervisor of the department of vocational education of Nevada.—The Editor.)

METERING CURRENT AND PRESSURE

Measuring Current Flow.—In investigating the flow of electric current, it is helpful to think of measuring the flow of a current of water, an operation closely analogous. The device known as the "Pitot tube" (Fig. A) is sometimes used for this purpose. Through holes in the wall of a water pipe are inserted the ends of a U-shaped glass tube which contains a liquid slightly heavier than water—say orthotoluidine. One end of the tube points upstream

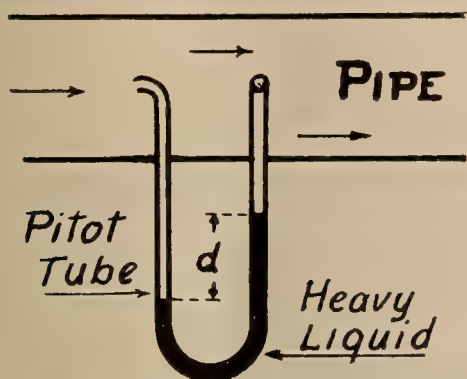


Fig. A.—The "Pitot" tube for measuring the flow of a current of water.

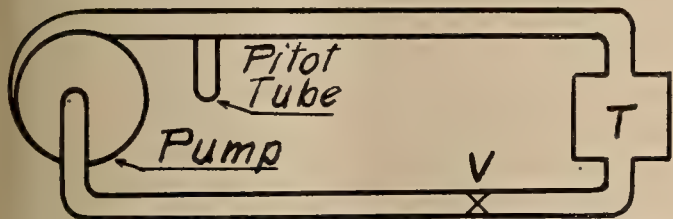


Fig. B.—Pitot tube installed to measure the flow from a centrifugal pump to a turbine.

and the other across the current. It is found that the liquid is depressed in one side of the tube by an amount d which depends upon the rate of flow of the water. Hence it is possible to mark or "calibrate" the tube so as to tell at a glance how many gallons per second are flowing in the pipe. This, then, is metering a current of water.

Fig. B shows a Pitot tube installed to measure the flow from a centrifugal pump to a turbine. With the arrangement indicated the water returns again to the pump. Closing valve V would stop the flow entirely. The Pitot tube would then read zero, as the liquid would stand level in the two sides of the U.

In Fig. C a generator sends current through an ammeter to a coil of wire when the switch S is closed. If the circuit is interrupted anywhere the current cannot flow, and the meter reads zero. Note that the ammeter, just like the Pitot tube or any other current meter, must be inserted in the circuit. To measure a current, then, **open** the circuit and connect the ammeter so that the current must go **through** it to reach (or return from) the apparatus

taking current. Different procedure leads to trouble (see Problem 12, below).

Pressure Meters.—For measuring water pressure we make use of apparatus different from the Pitot tube. Fig. D represents the "mercury manometer"

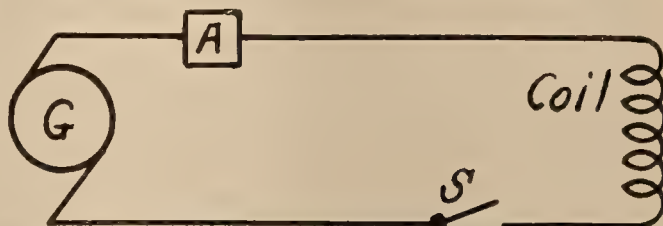


Fig. C.—Showing insertion of an ammeter in an electrical circuit for the purpose of measuring the current.

meter," one device for this purpose. A glass U tube containing mercury is arranged so that each end opens into one of the pipes connected to the centrifugal pump. The water pressure in the upper pipe forces the mercury down a distance proportional to the excess of this pressure over that in the lower pipe. If the pump stops running and so ceases to generate water pressure, the liquid comes to the same level in both sides of the U.

Another manometer is shown at the right of the same diagram. From its manner of connection it is



Fig. D.—The "mercury manometer"; a device for measuring water pressure.

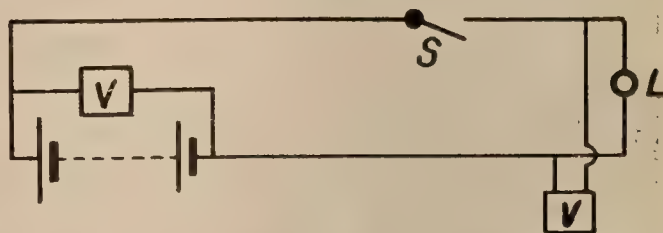


Fig. E.—Diagram of an electric circuit with a voltmeter at the left to measure the pressure produced by the battery, and another at the right measuring the pressure applied to the lamp.

evident that it measures the difference in pressure on the two sides of the turbine, T , or what is sometimes called the "head of water" applied to the machine.

If the valve V is closed, the flow of water is stopped and the waterwheel ceases to run. The right-hand manometer then reads zero. But the other continues to indicate the pressure produced by

the pump until the latter is stopped. There may be pressure without flow.

Voltmeter Connection.—The electric circuit in Fig. E is a very similar arrangement. By means of the voltmeter at the left we measure the pressure produced by the battery, while that at the right tells what pressure is applied to the lamp. When the switch is open the latter, of course, reads zero.

Note particularly that the voltmeter, like the mercury manometer, is connected **across the circuit**, from one line to the other. Voltmeters have high resistances (in many cases thousands of ohms) and hence only extremely small currents pass through them. Ammeters, on the other hand, have very low resistances, often $1/100$ of an ohm or less.

Examples.—If the pressure applied to the coil in Fig. C is 36 volts and the ammeter reads 2.5, what is the resistance of the coil? By Ohm's Law: Volts \div amperes = ohms; $36/2.5 = 14.4$. What would the meter read if the pressure were increased to 85 volts? $85/14.4 = 5.9$ amperes.

What current flows through a 15,000 ohm voltmeter connected across a 120 volt line? $120/15000 = .008$ ampere.

A "mil-ammeter" shows that a current of 37 "mil-amperes" (= 37 thousandths of an ampere) is carried by a 730 ohm resistance. What voltage is applied to it? $.037 \times 730 = 27$ volts.

Solutions of Previous Problems

1. Voltage = amperes \times ohms = $1.8 \times 2.5 = 4.5$ volts.
2. Resistance = volts \div amperes = $380/68 = 5.8$ ohms.
3. $2 \div 155 = 12.9$ ohms.
4. Current = volts/ohms = $120/48 = 2.5$ amperes.
5. Voltage = $46 \times .074 = 3.4$ volts.
6. Current = $81/2100 = .0386$ ampere.
7. Resistance = $220/.27 = 815$ ohms.
8. E. m. f. = $.92 \times 3.3 = 3.04$ volts.
9. Resistance = $4.1/58.5 = .07$ ohm.
10. $6/1.2 = 5$ ohms; $6/.86 = 7$ ohms. The resistance of copper increases about 40% as the temperature rises from freezing to boiling (32° to 212° Fahr.).

Note: The careful student will in many cases obtain answers slightly different from those presented in the "solutions." For instance, in No. 7 the correct result is 814.814814814 +, but there is no use for such accuracy. 815 is the nearest three figure number. Again, in No. 8 the exact answer is 3.036, but the nearest number that would be read on a meter would be 3.04.

New Problems

11. To measure the resistance of his own body, a man takes hold of the wires from a 12 volt automobile generator. A meter in one of the lines reads .2 of a mil-ampere. What is the resistance of his body in ohms?

12. The new man in a charging station connected a .006 ohm ammeter between the terminals of a storage battery, having mistaken the instrument for a voltmeter. If the battery supplied 9 volts, (a) what current did the meter get (b) what did the man get?

13. Find the reading of a "millivoltmeter" connected to the ends of a piece of metal of .000032 ohm resistance which carries 690 amperes. (This meter reads in thousandths of a volt.)

14. What is the current through the metal when this millivoltmeter reads 40?

15. A certain coil takes .735 ampere from a 108 volt line; find the pressure applied to make it take 8.5 amperes.

16. A 15 ampere fuse blew when a piece of apparatus of 7 ohms resistance was connected to a house circuit. What do you know about the voltage?

17. A 16 candlepower carbon lamp takes $\frac{1}{4}$ ampere on a 220 volt circuit. If it is connected by mistake to a 550 volt circuit what current would flow providing the resistance did not alter?

18. A 220 volt heater takes 4 amperes on "high heat," 2.75 on "medium," and .86 ampere on "low heat." Find resistance of the heating unit in each case.

19. One terminal of a 240 volt generator is connected through a mil-ammeter to a telegraph wire which is insulated from the ground. When the other generator terminal is grounded the meter reads 6.2. This current evidently leaks through the insulators to the earth. What is the insulation resistance of the wire to which the instrument is connected?

20. In Fig. B, if the valve were open and there were Pitot tubes installed at several places around the circuit, would they all indicate the same current? Why?

21. The resistance of the lamp in Fig. E is 24 ohms; that of the entire circuit outside of the battery is 25.6 ohms. What do the voltmeters read if the switch carries 1.25 amperes?

22. Each of these meters has 2240 ohms resistance. What current flows in each?



This picture of the opening of the Salem office of the Portland Railway Light and Power Company shows how this occasion can be made the excuse for a charming social affair which acquaints customers with employes and the shop and awakens the employes' pride in their new home.

CLASS OF SERVICE SYMBOL		WESTERN UNION TELEGRAM		CLASS OF SERVICE SYMBOL	
Telegram	Blue	Telegram	Blue	Telegram	Blue
Day Letter	Blue	Day Letter	Blue	Day Letter	Blue
Night Message	Blue	Night Message	Blue	Night Message	Blue
Night Letter	Blue	Night Letter	Blue	Night Letter	Blue

RECEIVED AT 020 MAY 30 PM 5 21

A205SF 11 COLLECT

PA PALMFRANISCO CALIF 206P 30

JCH, K WILSON

243 JUNIPER ST NEWYORK NY

HELEN AND I JUST MARRIED WERE LOVE AND SOME MONEY

HARRY

CLASS OF SERVICE SYMBOL		WESTERN UNION TELEGRAM		CLASS OF SERVICE SYMBOL	
Telegram	Blue	Telegram	Blue	Telegram	Blue
Day Letter	Blue	Day Letter	Blue	Day Letter	Blue
Night Message	Blue	Night Message	Blue	Night Message	Blue
Night Letter	Blue	Night Letter	Blue	Night Letter	Blue

RECEIVED AT 190 MAY 30 PM 2 14

ST. PAUL

PA NEWYORK NY 552P 30

HARRY, NEWYORK

PALACE HOTEL SANFRANISCO CALIF

YOU HAVE MY LOVE AND SYMPATHY AM WIRING YOU HEREWITH ENOUGH MONEY TO PAY FIRST DRESSMAKERS BILL LETTER FOLLOWS

DAD

The answer to the average telegram sent from San Francisco to New York is received exactly thirty-seven minutes after the original message is sent.

Modern Telegraph Service

BY R. B. CALKINS

(The progress of a telegram from the time it is passed over the counter, telephoned to the telegraph company or called for by the messenger, to the time it is delivered to the addressee, is a story of the development of the highest type of efficiency in modern business. This article by an assistant to the general manager of the Western Union Telegraph Company's Pacific Coast Division describes the history of a telegram and the workings of the most modern telegraph office in the world and the third largest in the United States—the new San Francisco Western Union office.—The Editor.)

Between the writing of the first message above and the receipt of the answer, less than an hour later, an almost unbelievable amount of activity has been carried out to get the message through. And this is repeated thousands of times a day. During the Democratic Convention in San Francisco over 4,500,000 words of convention news were sent—in one day over one-half million words. Many comments on the service were given as this was the first convention of the kind to be reported over the multiplex system.

Life History of a Telegram

To make clear the extent and functions of this equipment the typical message shown above will be followed in its progress through the speedy channels. We may read this message conscience-free. It is only "faked;" no one except the operators who send and receive it would otherwise see it.

This wire was filed, let us say, in the Palace Hotel branch office of the company. There the clerk read it back to the sender, counted the number of words, and (if Harry had not needed the money more) would have collected the tolls according to its classification. This particular wire was sent "collect," for obvious reasons, and as the need was urgent it went at the fastest rate—"straight telegram"—or, in telegram parlance, it was a black message. Other Western Union services to meet various needs in the most economical way, are the Day Letter, the Night Letter and the Night Message—or "Blue" "NL" and "Nite" as the telegraph people abbreviate the names.

The Palace Hotel branch clerk immediately put the message in a leather cartridge and slipped it into the pneumatic tube which whisked it under the streets to the main office in the Bankers Investment

Building, two blocks away, in fifteen seconds. There it was breathed out on a table on the fifth floor in front of a young lady who opened the carrier, noted that the message was to go to New York and that it was "black." She placed it on a fast belt conveyor which in ten seconds more dropped it in the "New York" compartment fifty feet down the room in front of another apparently unhurried young lady, who immediately set it in a rack at the side of one of the girls who were punching "multiplex" messages for New York. Total time from the Palace Hotel to the New York wire, one-half minute. Here for a moment the demon Speed sits down to breathe, while the motto "Accuracy First" presides over the ensuing operations.

At this point the message entered the most interesting phase of its history—its handling by the "Multiplex." The multiplex system was first conceived, in its crude state, by a Frenchman of the name of Baudot. Baudot had not the technical skill, the engineering staff or the support of a progressive public utility to develop the apparatus beyond the European Government ownership standard, and it was taken up and brought to its high state of present development by the Western Union Telegraph Company. The detailed construction and operation of this apparatus will be described later.

The multiplex operator, using a machine with a keyboard almost identical in appearance with an ordinary typewriter key-board, "wrote" the message just as it appeared on the original message blank except that holes were perforated in a tape instead of letters being written on a sheet. When the machine decided that she had written enough on one line it lighted a red light that warned her to press the car-

riage return key, because she was controlling a receiving typewriter three thousand miles away, and when the message was completed the operator, pausing only to note her number sheet, picked up the next message to continue the steady procession of electric flashes of thought across the continent. At the other end of the line, in the New York office, another type-



Portion of the multiplex section of the operating department

writer-like machine received the message automatically, typing it faithfully—spaces, figures, lines and all—just as it was sent through the holes in the distant tape. It did this at the rate of forty-five words per minute, although it has a possible speed of over sixty-five words per minute. The slower rate was used as there were three other messages going to New York over the same wire at the same time and, in addition, there were four messages being received from New York over that same wire at the same moment—a total of eight messages over one wire simultaneously.

In New York, after the message was received, it was transferred by the rapid-transit belt conveyor to the telephoning operators who called the addressee on the phone and read the message to him—sixteen minutes after his son had handed it to the clerk in the Palace Hotel in San Francisco. Dad wanted to be obliging, recalling his own experience, and when the telephone operator asked if she might take the answer immediately, he dictated it to her while she transcribed it on her typewriter, and, after repeating it back to him to assure its correctness, it was shot up to the New York multiplex operator who started it on its instantaneous 3000 mile ride to San Francisco.

Speed

As soon as the multiplex receiving set in San Francisco had ticked off the last word and the signature, the operator tore off the blank from its roll of continuous message forms, endorsed the received time on its face with her electric time stamp connected with a Western Union clock, and after a ten-second ride on the belt conveyor it was put in the pneumatic tube which landed it at the Palace Hotel thirty seven minutes after Harry filed his "S.O.S." Every Western Union "black" or "blue" message—

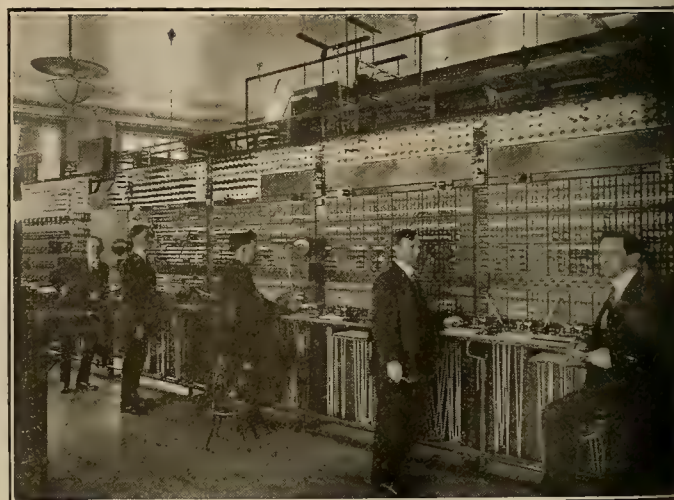
the day-time services—show both filing time and received time in plain figures to the addressee.

Of course this time is not experienced in every case, as some know. Yet messages are being exchanged—sent and answered—between San Francisco and New York within ten minutes every day. The messages are almost literally geared to an inexorable time schedule from the moment they enter the operating room until their transmission has been completed. Out of every 2,500,000 messages—one month's run—2,400,000 go through the tubes, telephone department and belt handling, take their turns at the wires and are completely transmitted and filed away, all within ten minutes total time. The tardy four per cent may take one or a few minutes more. Naturally, when a message is sent on any of the hundreds of direct circuits it is received at the other end at the same instant. It is not merely possible but frequent that a telegram is filed at a branch office and received in New York within fifteen minutes.

Seemingly such speed could not be lowered, but 5000 messages from San Francisco to Los Angeles will show an elapsed time averaging only 7.6 minutes. To Fresno the average time is but 6.1 minutes, to Seattle 7.1, to Portland 6.3, and so on. With instantaneous pneumatic tube service adding but a fraction of a minute and an allowance of four minutes for switching and delivering the message by telephone at the distant office, fifteen minute service from customer to customer can be comprehended. The figures given are averages, and necessarily include thousands handled within two or three minutes.

The San Francisco Office

The physical plant equipment that makes such speed possible includes not merely the wire lines



Switchboard connecting the various transmission lines to different sending and receiving positions

themselves but also the branch offices—of which there are 30 in San Francisco; the pneumatic tube system—which is composed of 13 miles of 2¾ in. copper tubing, costing \$1.20 a foot, laid under the city streets to connect all of the downtown district branch offices with the main office: the main office apparatus itself, and particularly the multiplex equipment.

Tube transmission, eliminating all possibility of error and crowding speed to the limit, is the latest and most costly refinement of telegraph practice.

Branch Offices

The function of the thirty branch offices is of course to receive the messages brought into them from the districts in which they are strategically located, transmit these to the main office for sending, and to deliver such as are sent out to them from the main office. Each branch office is the center of a network of messenger call wires which reach into nearly every office in every office building, every hotel and all other public places from which customers may wish to send telegrams. Six thousand of these boxes are in use in San Francisco every day. From these offices the boys go in answer to the calls by phone or buzzer, and here clerks are ever ready to take messages and answer questions regarding service. Daily bulletins and monthly educational meetings keep them always informed of the constant changes in the telegraph situation. An innovation in the larger offices is the typist in the front lobby at the service of any customer who desires assistance in writing his message. Usually it is the busy man who is in a hurry and wants to send a message and retain a carbon copy. The typist quickly types it for him, without extra cost and graciously declining every proffered "fee." Again it is a confused foreigner in a quandary over the preparation of a cablegram to sunny Italy. In cable transmission half way around the world a moderate amount of silence is golden. He is helped to save, to the ultimate word, and goes away a friend forever.

The Pneumatic Tube System

The pneumatic tube system is being completed in San Francisco now, the Market Street section hav-

panded joints may be made at the ends of the 15 ft. sections, completely preventing the loss of pressure and each of the tubes is closely fitted in a creosoted wood duct. Entering the Bankers' Investment Building at 722 Market street, wherein are the main offices, are 24 trunk tubes. Power for operating these tubes is generated by two 35-hp. induction motors

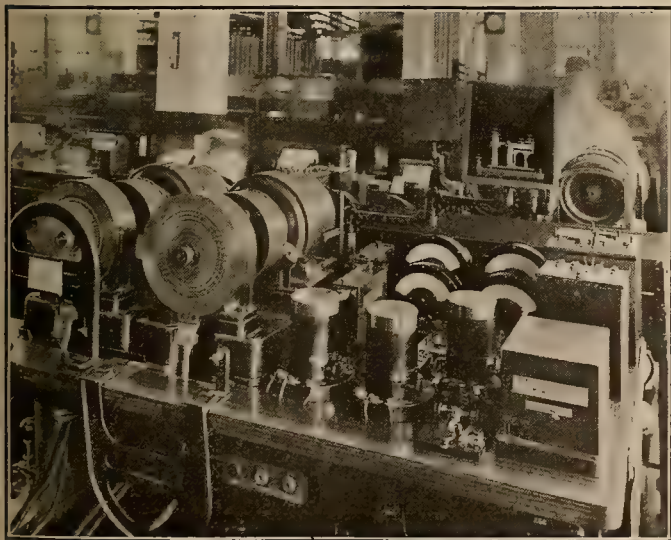


A multiplex set; left to right—receiver, transmitter, perforator.

each driving a 14 x 18 compressor. A third unit is to be installed shortly for standby service. These machines operate a combination pressure-vacuum circulating loop system driving and pulling simultaneously, so that the tubes operate under a vacuum of approximately 10 in. of mercury in combination with 5 lbs. absolute pressure, driving the flanged cartridge message containers through the tubes at a speed of 40 ft. per second. The tube system is the exponent "n" in telegraph practice.

Distribution of Messages

The greatest economy of time is effected in the handling of messages from the time they are shot out of the tubes until they are on the wires. As shown in the illustrations the enclosed belt conveyors traveling 250 ft. per minute interlace over the entire room. Each is driven by its individual motor and every precaution is taken that nothing goes wrong with any of them. In fact there are two men whose only duty is constantly to go around the room, stop each belt in turn for a few seconds, lift it up, look under it to see that no message has slipped out of place, test it to see that it runs freely and then start it again. These are super-precautions: their search is never rewarded by a lost message, and the many checks should prevent one from ever being lost. One noteworthy item is that there is not a single waste basket in the entire operating department—everything is kept off the floor and there are no drawers, desks or pockets. There is in fact no waste paper. Everything is messages, and they have only two divisions—completed and awaiting completion. Order is the first law of the operating department, and the visitor promptly gets the impression that a message out of its course would be nothing short of horrifying.



Close-up view of the multiplex distributor

ing been hurried to completion in anticipation of the rush of Democratic Convention newspaper "specials." Tubing of pure copper is used to resist electrolysis and chemical action and because it presents an over-smooth surface to the carriers. It is also quite uniform in internal diameter and excellent triple-ex-

Handling of Local Messages

As the demands of the smaller offices do not warrant the use of the multiplex equipment with its rapacious appetite for telegrams, the traffic to and from them is handled by manual (Morse) operation. Half of the operating room is given to Morse sets, 150 positions being provided. These are divided into "telegeographical" divisions, offices such as Turlock, Merced, Modesto, Fresno, etc., being brought into one aisle. The same operators both send and receive messages, and in order to receive the messages coming to them, amplifying resonators swing close to their ears to isolate each receiving sounder in this modern Tower of Babel.

Messages after being sent, then held in suspense for forty-eight hours, billed and accounted for, are put in the files, hour by hour, and day by day, to be kept for twelve months in case of future inquiry by the senders. Tons of these superannuated telegrams must be destroyed by burning. Nothing but complete incineration satisfies the company's inviolate rule of secrecy for its patrons' business.

The Western Union Multiplex System

A text-book would be required to describe completely the complex apparatus and wiring of the Multiplex equipment and its auxiliary testing and regulating devices. Briefly it might be attempted by explaining that the theory of Multiplex transmission is the apportionment or distribution of the use of the wire to eight different transmitting machines in rotation for equal periods of time—for a very brief instant each transmitter uses the line and in succession the other seven take their turn. The intervals are so rapidly distributed that each machine transmits its individual signals without noticeable interruption, and in fact a transmitting speed of one word per second on each channel is in effect today over Western Union circuits between San Francisco and St. Louis. Between San Francisco and Los Angeles a single wire carries 400 words per minute—50 words in each direction over four channels.

The essential equipment consists of a keyboard tape-perforator, which translates the words of your message into groups of holes in a tape; a transmitting machine which forms series of electrical contacts with the line through the group of holes; and a distant receiving typewriter which receives the impulses in the form of selector signals actuating a type-wheel. At each impulse the type-wheel turns the selected letter-face to the receiving blank and strikes the letter. Between the impulses seven other receiving machines (a total of four transmissions in each direction) are being actuated in the same way. Each transmission is over the same wire, but the individual periods are called "Channels," there being a sending and receiving machine at the ends of each "channel."

The distribution is effected by a rotary "distributor." The face of the distributor, as illustrated is—fortunately for explanatory purposes—the base of operations. The disk is divided into sectors, usually quadrants, each of which represents a separate "channel." The "line" is connected to the distribu-

ting brushes which are sweeping over the disks so rapidly that they cannot be seen in the illustration, and they pick up the transmitting impulses from each of the four quadrants in turn as they pass and transmit them to the line. In one whirl of the brushes four letters—that is, their impulses—have been taken from four transmitting machines, shot in equally rapid succession to the line and fed into a receiving distributor at destination which with the same impartiality and composure distributes them in proper order to the four receiving typewriters. Each typewriter operates at such a speed that it is almost unbelievable that the intervals could have permitted the transmission of other impulses to other machines, but to preserve accuracy even at the risk of losing several incredulous readers at this stage,—**four more** messages, not previously heard from, are going over the same wire in the **opposite** direction.

Each segment of the distributor face is further divided into five insulated zones,—one for each of the five perforations in the tape. Metal fingers on the transmitter jump through the perforations where they can, or are blinded and rejected by the absence of holes, and thus a current is or is not passed to the corresponding zone of the distributor segment. If No. 1 hole and No. 2 hole are open, while the other three are not perforated, No. 1 zone and No. 2 zone of this particular channel receive an impulse, while the other three are inactive on this pulse. Therefore these two holes permit these two impulses only to pass over the line into the receiving distributor at the distant end, where by perfect synchronism the brush is then passing over that particular segment, and the combination 1-2 is distributed to the selectors of the receiving typewriter which then combine to select the letter "A" on the type-wheel. If the combination of the second and fourth holes is active and the others passive, the letter "R" is selected and struck on the yellow blank.

Obviously it is necessary for the brushes of the transmitting distributor and the brushes of the receiving distributor to pass the corresponding or mating segments at the same absolute instant, and this is done by a phonic wheel—or tuning forks—at each end, driving the brushes in perfect unison by the energization and de-energization of their propelling magnets.

The perforating machine holds a roll of specially prepared tough paper, 11/16" wide and 1/500" thick, the rolls being 250 ft. long—enough paper for 300 average-length messages. The paper feeds out of the machine between the perforating dies as fast as the operator writes, and immediately enters the transmitting instrument. Here another advantage of this Western Union system becomes apparent: the interruption of the wires over a great area, as by a sleet storm, brings Morse operation to a standstill until the re-routing is accomplished, while with the Multiplex the operators can continue to prepare tape, keeping up with all traffic, and when the wires are restored or re-routed the jam is instantly recovered.

In the transmitter (the small box between the perforating and receiving sets) there is a row of five pins engaging the letter holes in the tape and a

central pin operating through the row of drive-holes to conduct the tape steadily through the instrument. The five signal holes form 31 combinations to figures and punctuation which are formed by a prefix-signal operating a new set of selectors, and among these signals there are of course impulse combinations which actuate the carriage-return and paper feed of the receiving instrument. A novel angle of the perforating operation is observed when the operator presses the key which jumps the carriage back to the beginning of a line. So far as she sees the result the tape continues on its way, but she is controlling a typewriter a continent's breadth away, and the signal to warn her of the approaching end of a line is given by the flash of a red lamp.

The apparatus described thus far nevertheless would lack one vital element for practical operation if the operators at either end could not instantly communicate with each other in case of need. A signaling arrangement, therefore, completes the equipment. In appearance and operation it resembles an automatic "Home" telephone signalling device, and gives a choice of five signals, by which the receiving operator, watching the incoming message, can transmit bell signals instructing the sending operator to stop, start, re-run tape, re-punch tape, or call the equipment expert and circuit-supervisor. Should the latter be called in, he can convert the whole complex system into an ordinary Morse duplex circuit by the turn of a switch, carry on a hand conversation with the men at Flagstaff, Albuquerque, Amarillo, Kansas City and Buffalo who have jumped to the wire at the alarm call, and in a few seconds adjust the long circuit, or snap out one set and replace it with a spare, replace the switch and resume normal operation.

Among the famous sayings of famous personages, the old lady's remark that "there ain't no such animal" occupies a classic position. It reflects the feelings of the visitor who finishes an inspection of the Multiplex in operation, but in the end the evidence cannot be denied that it works,—works almost without interruption or trouble, day after day and month after month, carrying 65 per cent of the traffic over the Western Union wires, at unthought of speed and above all, with unmatched accuracy.

Transmission Lines

Entering the San Francisco office are 2000 wires containing the existing working circuits, spare facilities and provision for growth and extension. Wires lead directly from San Francisco to New York, Chicago, Dallas, St. Louis, Kansas City, Denver, Salt Lake, Los Angeles, Portland, Seattle, Spokane, and innumerable other wire centers and local offices on the Pacific Coast.

These wires terminate in a switchboard, which in itself is a thing of beauty to the eye of one who knows and appreciates skillful design and fine workmanship. The operation of the board is by means of plugs and cords which enable the various lines to be connected to different sending and receiving positions.

Personnel

In common with the most advanced ideas and ideals of the larger public service corporations, the Western Union Company has provided well for the comfort and convenience of its operating force. Commodious locker and rest rooms, furnished appropriately, permit the employes to rest and refresh themselves during their hours off duty. Even the messenger boys are adequately provided for with reading rooms, shower baths and lockers.

One particular point, in conclusion, which in a way explains the efficiency of the entire force is the fact that this year sees the beginning of the application of an experimental income sharing plan. After the expenses of operation, interest, maintenance and a fixed dividend are deducted the balance of the income is divided equally between the stockholders and the employes. The scheme of division among the employes is based on their rates of pay, and as the rates of pay are somewhat contingent upon their length of service, this basis is expected to prove highly satisfactory. Life insurance, sickness benefits, pensions and vacations with pay run far into the millions in providing for the 60,000 employes, well repaid by the efficiency of the corps, it is true, but also affording both company and employes, each to the other, the gratification of a broad duty broadly done.

LIGHTING THE FACTORY

It is now a recognized fact that improved lighting improves production. In fact, records show that production increases ranging from eight to thirty-five per cent have resulted from improved plant lighting. And even more significant than this is the fact that this increase has resulted at an increase in lighting cost ranging from only one to five per cent of the pay roll.

Some time ago a representative of the National Mazda Lamp Company prepared the following analysis covering average conditions for a plant employing 100 men. In this case the annual cost of lighting, including everything, amounts to 1.41 per cent of the pay roll. It is felt that this analysis is of particular value to the contractor in securing an industrial lighting contract.

Relation of Lighting Cost to Pay Roll

Initial Cost of Installation

100 outlets @ \$10.00 per outlet, including labor, conduit, wire, etc.	\$1,000.00
100 RLM Reflectors and Ivanhoe Holder No. 822, @ \$3.96, less 29%	281.16
100 200-watt Mazda C Bowl Enameled lamps—\$2.30, less 17%	190.90
Total installation cost	\$1,472.06

Annual Operating Cost

Fixed Charges

Interest and insurance @ 10%	\$ 147.21
Depreciation on wiring @ 10%	100.00
Depreciation on reflector equipment @ 12½%	35.15
Total	\$ 282.36

Maintenance Charges

Lamp renewals	\$ 190.90
Cleaning of units @ \$1.00 each per year	100.00
Total	\$ 290.90

Energy Charge (1,000 hours)

Current @ \$0.06 per kw-hr.	\$1,200.00
Total	\$1,200.00
Total annual operating cost	\$1,773.26

Cost of Labor

100 men for 50 weeks @ \$25.00 per week	\$125,000.00
The ratio of the annual lighting cost to the pay roll is the ratio of \$1,773.26 to \$125,000.00, or 1.41 per cent.	

Advertising

BY HOWARD ANGUS

("It pays to advertise" is now a truism, but how to advertise, where to advertise, and what to advertise are still subjects worthy of discussion. Following is the first of a series of brief articles by the secretary of the California Electrical Cooperative Campaign, taking up the question of advertising from the viewpoint of the electrical contractor-dealer.—The Editor.)

The purpose of this paper is not to present an argument in favor of advertising, an argument which is and ought to be unnecessary, but rather to emphasize the more important facts of advertising which electrical contractors and dealers should know and understand.

The meaning of the word "advertise" is to make known, and it embraces all business efforts that make people talk about you and your business, and come

Let us consider what appeal you have to make as an electrical merchant to each of these five motives.

How many people buy appliances for financial gain, either to make money or to save money? A factory and store owner or any other business man uses electricity for both reasons. But how about the woman in the home? Your appeal to the housewife in behalf of electric appliances from a financial standpoint is in the matter of saving money by the elimination of servants, wash bills, and the like. Inasmuch as most women are trying to make a 1914 salary stretch over 1920 costs, they are interested in anything that saves money. This argument, however, can be used better to offset the cost of an article than as the direct reason for purchasing it. For instance, with the washing machine, appeal is usually made to saving of time and labor. The argument that a woman has against spending so much money for a washing machine is answered by showing her how she can make up the price of the machine on the laundry bills and saving of clothes.

There is practically no appeal to the housewife on necessity. People can get along without electric

THE SATURDAY EVENING POST

You are entirely safe in accepting the very obvious difference in the way the Liberty rides and drives, as a voucher for quality of the soundest sort.
Liberty Motor Car Company, Detroit

LIBERTY SIX

The above specimen has a number of the hallmarks of good advertising. There is plenty of white space; the printed matter is concise and readable; the name of the advertised article is boldly conspicuous, catching the eye of even the casual observer, and the picture in each case tends to arouse the desire for possession.

to your store to buy. As applied to the retail merchant it means not only to make himself, his business, his location and the goods he sells known to the public, but to keep these continually before the public. If I were to ask any contractor and dealer to give me the names of twenty electrical contractors and dealers, he would name the men he sees the most frequently, knows the best, or hears the most about. The man you seldom see or hear about is soon forgotten. It is the same way with the public; it knows best the store seen most often and heard about continually. The purpose of advertising is just that—to keep your store and business before the public.

Motives for Buying

You advertise for the same reason that you are in business—to sell goods. The appeal must be to the buying motives, which govern people in the purchase of articles. There are five buying motives: (1) Financial Gain, (2) Necessity, (3) Pride, (4) Convenience, (5) Luxury; and the greatest of these are pride, convenience, and luxury.

THE SATURDAY EVENING POST

Shoes of Worth

Nettleton

FOUNDED 1854 by Nettleton, who is the... A. J. NETTLETON COMPANY, MANHATTAN, NEW YORK, U. S. A.

Another example of the type of advertising which creates a desire to buy through its suggestion of quality and luxury

appliances, as experience has taught you. They may not be able to get along so well but they can get along, nevertheless.

The buying motives to which the contractor and dealer should appeal all the time are pride, convenience and luxury, and all other appeals should be secondary to these. Stop and think how much these three mean in all purchases for your own home. Why

are you not living like the aborigine, in a tent or a shack? It would save you money and cover all the demands of necessity, protecting you from the elements. You are living in a modern home or apartment because you have pride, because you want convenience and love luxury or the show of luxury. With the woman the home is the center of practically all her dreams and hopes and their foundation consists of pride, convenience, luxury.

Even eliminating the drudgery of housework can be translated into terms of pride, convenience and luxury. Dorothy Blake says, in *Electrical Merchandising*: "It isn't the drudgery of housework that most women mind, it is the way this drudgery affects her personal appearance and diminishes her charm. Electricity raises her dignity, helps her poise, adds to her charm, and therefore a woman buys electric appliances." The appeal of your advertising as of your selling efforts should be built around the motives of pride, convenience and luxury. Have you been appealing to these three in selling wiring jobs and appliances?

Function of Advertising

The same basic principles apply to advertising as to selling. The four principles are:

1. Gain attention.
2. Secure interest.
3. Awaken desire for the articles or service you have to sell.
4. All resulting in action, or the actual purchasing of the article.

Advertising has largely to do with the first three, that is arousing attention, interest, desire. Their purpose, however, is to bring the people into your store where your salesmen can close the sale and allow you to ring up the money in the cash register. So in all your advertising as in all your sales effort stop to analyze and ask yourself, "Does it catch their attention? Does it interest them? Does it awaken their desire? Will it bring them into the store?"

In all advertising, as in all sales effort, the electrical contractor and dealer is selling a service rather than an article. It is not the washing machine that he is selling but the service that the washing machine will render. It is not the vacuum cleaner, but the service that the vacuum cleaner will give. It is not the wiring job, but the service that the wire will perform in the home. If your sales effort is all spent in describing the article, instead of telling what it will do, in telling all about the wiring job instead of the service it will perform, neither your advertising nor your sales talks will ever get you very far.

In connection with the subject of service you can well employ a slogan that emphasizes this factor of your business. You should spend considerable time in thinking out the proper wording, for it is important. A distinctive slogan of any kind that states a fact about your business is excellent advertising and every contractor-dealer should have one.

For the purpose of this article advertising will be treated under the following subjects:

1. Newspaper advertising and publicity,
2. Direct advertising, that is by mail and personal distribution,

3. By display signs, such as on delivery wagons, in street cars, on bill boards and electric signs,
4. Show windows,
5. Store display.

This paper is not an argument for which form of advertising is the best, because it is the belief of the Advisory Committee of the California Electrical Cooperative Campaign that all forms of advertising should be employed unless the business is so small that the dealer would merely scatter money around and dissipate his efforts. However, he should at least use the newspapers and direct advertising, have an electric sign, a good show window and store display.

The Advertising Appropriation

The first question that an electrical contractor and dealer should ask about advertising is how much money he should spend. The Advisory Committee has recommended, after careful investigation, to every electrical contractor and dealer who has a growing business that he set aside each January 1st, 3% of his anticipated gross business for the incoming year as his advertising appropriation. In other words, if your gross sales for 1919 amounted to \$75,000 and you believe that during 1920 your gross sales will amount to \$100,000, then your advertising appropriation for this year should be 3% of the \$100,000 (not of \$75,000), or \$3,000. This figure includes and applies to the contracting department as well as all others. The contractor-dealer, as a contractor has goods and service to sell and, therefore, something to advertise. A man starting in business or advertising for the first time logically should spend a greater per cent—approximately 5%.

This recommendation of the Advisory Committee is conservative in accordance with its general policy, and should not be considered as the maximum. In an article that appeared in the *Electrical World*, Mr. L. B. Gibbs, Supt. of Advertising of the Edison Illuminating Co. of Boston, said:

"In our minds, in the Boston Edison Co., we feel that we do very little display advertising in the newspapers compared with the size of our business and the territory we cover. I was talking not long ago with Mr. Richards, advertising manager for Jordan-Marsh. I asked him about the percentage of their gross that they allow for display advertising and about some of the different angles of their policies. He said: 'I should think, in your electrical business, if a store on its own account, or a man running an appliance store by itself, or a central station spent 5 per cent of its last year's gross on this year's advertising, this would be doing very well and would get wonderful results.'

"You will be interested to know that it has been figured very carefully that if you spend \$5,000 this year for advertising you will have \$4,000 worth of that advertising coming to you next year, and \$3,000 the next, \$2,000 the next and \$1,000 the next. Thus the \$5,000 that you spend this year will have pulling power in diminishing ratio through five years, but it won't have that pulling power unless you add to it and keep it alive. So, if you put in \$5,000 this year for advertising and \$5,000 next year, you will really get \$9,000 worth of advertising next year. You put in \$5,000 in the third year and you have \$12,000 worth of advertising; that is, you secure this effect in your third year if you keep your work going right along. That runs to a certain period and begins to build up again. Therefore a man beginning in business should use 7 to 10 per cent of his gross in advertising. If part of his business is with nationally advertised commodities, he can reduce that 7 to 10 per cent to 5 or 7 per cent in the beginning of his business. When he gets well established he can do very well with from 2 to 5 per cent of his gross, and if he is handling national products he can easily go down from 1 to 3 per cent of his gross."

Electrical Cooperation in Salt Lake City

BY E. H. EARDLEY

(In few branches of the electrical industry is progress more marked and energetic than among the contractors and dealers. Following is an account, by the proprietor of the Eardley Electric Company of Salt Lake City, of the work which is being accomplished by the contractor-dealer association of that city.—The Editor.)

For the past twenty years it has been my good fortune to be connected with the electrical industry. I have seen it grow from very small proportions, during those twenty years, to the commanding position which it now occupies in the industrial and commercial life of our city and state, and of the whole nation. The changes have been tremendous.

Destructive Competition vs. Cooperation —

Prior to the organization of the present Electrical Contractors and Dealers' Association of Salt Lake City the business was a "hit-or-miss" affair,



Electrical Contractors and Dealers' Association of Salt Lake City, the group including jobbers and representatives of the Utah Power & Light Company. This flourishing organization is a strong influence in the electrical industry of Utah.

and every man engaged in it was considered by the other fellow as an unworthy competitor. Strife, jealousy and unethical methods were the rule.

As a result of the foundation laid by the men in this industry during the last twenty years, and more recently through the splendid efforts of some of our fellows, we have emerged from this chaos and are learning the great lesson of "Live and Help Live."

Our electrical contractors organization of the past has flourished, died, and been resurrected a number of times, but even when the organization slumbered some of its members had faith in its final permanent establishment, with the result that the present organization is firmly founded, and will accomplish its object of raising the standard of electrical contracting and merchandising, and thereby help every member of the industry.

The central station man of today is working in harmony with the other branches of the industry as he never did before. To our own Utah Power & Light Company much credit is due for the foresight they have exhibited in cooperating with the con-

tractor and dealer in the development of the electrical industry.

Our jobbers, men of experience and ability, continue their fatherly interest in our organization, and they, too, are bending every effort toward our success.

Organized Effort —

Our association meets regularly each Tuesday noon for luncheon, and our attendance is nearly 100 per cent. At these meetings we have a regular order of business and a blackboard demonstration, which is led by one or another of our members, as circumstances permit. Diagrams, sketches of fixtures, and methods of cost finding are chief among the subjects discussed, and much valuable information is gained.

The first Tuesday in each month is called "Jobbers' Day," at which meeting the jobbers and representatives of the Utah Power & Light Company also attend. On these occasions the time is generally devoted to general discussion, which discussion is always very interesting and instructive.

Each month there is a "Social Night" to which affair all the electrical men and their ladies are invited. On these occasions there is speech-making, music, dancing, refreshments, and a general good time. Experience has taught us the value of these social gatherings in the promotion of good fellowship.



Better merchandising is one of the watchwords of the new cooperative movement in the electrical industry. Above is shown the interior of the Eardley Electric Company's well-arranged store in Salt Lake City.

We have also entertained many visitors, and in this way try to keep in touch with the "other fellow."

Cooperation is the watchword of the association, and it is being lived up to. This in a measure is the outcome and development of the past few years with us. The old feeling of animosity or disinterestedness has been forgotten, and we are uniting to produce a spirit of good fellowship and a breadth of vision which means success.

A Central Station Opportunity

BY R. W. GODDARD

(Small current-consuming devices constitute an important load in the development of the central station. Following is an idea from a paper presented at the recent convention of the New Mexico Electrical Association, suggesting an opportunity which has been to a great extent overlooked.—The Editor.)

The wide awake central station is always searching for new uses to which electric current may be put. One field but slightly developed at the present moment, but capable of considerable expansion, is that of automobile storage battery charging. Nearly every auto owner of over two years' standing has experienced battery trouble. The reason for the greater part of this is what is termed "local action"

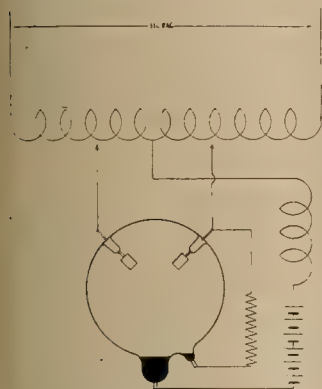


Fig. 1.—Mercury Vapor Arc Rectifier.

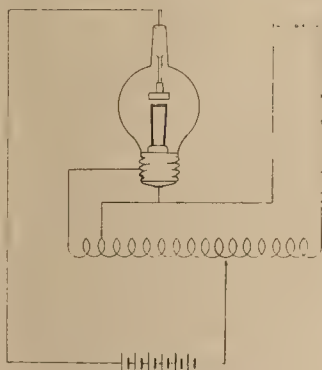


Fig. 2.—Thermionic Vacuum Tube Rectifier.

in the cells. This occurs because of impurities introduced with the addition of water. Since these impurities accumulate as the battery becomes older, this action increases, but with proper charging devices in the hands of every car owner he could, at the necessary intervals, give his batteries extra charges over night without the trouble of visiting a battery service station or laying up his car.

There are on the market devices which are comparatively inexpensive, which will do this. These may be divided into four general classes: synchronous polarity switches, motor-generator sets, mercury vapor arcs and thermionic current tubes.

The synchronous polarity switch is usually a magnetic device which operates a pole changing switch in synchronism with the alternating current source, thus reversing the connections every time the current reverses and giving a unidirectional current for charging the battery. Another device utilizes a synchronous motor which runs a commutator, thus accomplishing the same results as before mentioned.

Motor-generator sets consist of small motors direct-connected to low voltage generators. Years of development have perfected these highly, yet they have troubles caused by their commutators and brushes.

The mercury vapor arc utilizes the peculiar characteristic of the electric arc through mercury vapor between a mercury cathode and graphite anode of allowing current to flow in one direction only. This

is due to the ionization of the mercury, which being ionized, has a strong negative charge and thereby electrons will leave it under the slightest voltages. Thus by arranging terminals as shown in Fig. 1, electrons will flow from the mercury to the anode which is positive to it at any instant. Through the cathode circuit the current is unidirectional and may be used to charge batteries. The arc is maintained through the points of zero potential by a choke coil placed in the cathode circuit which makes the current lag behind the potential—lagging power factor—so that before the arc to one anode has ceased, the potential to the other anode has built up sufficiently to establish the flow of electrons to it.

The thermionic current tube is a device utilizing the property of electron discharge through a vacuum from a heated body under electric pressure. Heated bodies emit electrons and the voltage applied will cause these to travel to a positively charged body. Fig. 2 illustrates how this principle is used. Within a glass tube is sealed a filament of tungsten and a

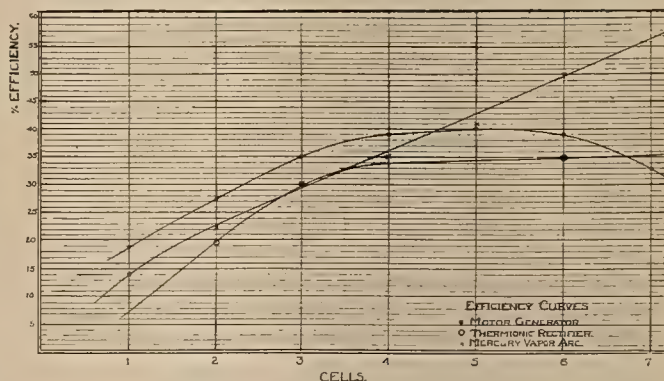


Fig. 3.—Curves showing results of a series of tests run on (a) motor-generator set, (b) mercury vapor arc rectifier and (c) thermionic rectifier.

graphite or metal plate. The filament is heated to incandescence by current from several turns of an auto transformer. When thus heated it emits electrons which travel to the plate whenever the latter is charged positively with respect to the filament. Since the plate is cool, no electrons are emitted from it and, therefore, there is no flow of current in the reverse direction. Thus through the plate circuit a unidirectional current is produced which may be used for battery charging.

For purposes of comparison, a series of tests were run on three standard alternating-current rectifying devices of approximately the same capacity: (a) motor-generator set, (b) mercury vapor arc rectifier, and (c) thermionic rectifier. The results of this test are shown in Fig. 3. The efficiencies run along quite parallel. From one cell they range from 10% to 20% and rise to from 35% to 50% for six cells.

A vigorous campaign on battery charging devices among car owners, similar to the well known flat iron, washing machine and electric stove campaigns, should be decidedly worth while. The load these devices would bring is desirable, being generally off peak, night load and of constant value.

The car owners would be greatly benefited by the convenience and greater life of their batteries, and the load of battery service stations would not be decreased appreciably since this home charging would be to a large extent charging that is now neglected.

Steam Power Plant Tests—II

BY H. L. DOOLITTLE

(Following is the continuation of the data on fuel oil economies obtained from extended steam power plant tests. The remainder of the material will be published in the next issue. The author is steam power plant specialist with the Southern California Edison Company.—The Editor.)

Boiler Efficiency —

Tests showed that the boiler efficiency is practically constant between 35% and 130% of boiler rating. Tests in which hot water was fed to the economizer resulted in a low efficiency. Two of the three tests on two boilers fell about 3% below the average efficiency. It was expected that the combined efficiency for two boilers operating on one economizer would be less than for a single boiler operated on the same economizer on account of there being just half the economizer surface available per boiler. It was also noticeable that the tests on the low loads which were made with fewer burners operating, gave better efficiency than those with a larger number of burners. This would indicate that it would be more economical to operate the boilers on light loads with either one or two burners instead of with all four burners.

The tests of the boiler equipped with three burners gave practically the same efficiency as those conducted on the boilers equipped with four burners. It was also possible to obtain the same maximum with three as with four burners. This would indicate that there would be some advantage in having future boilers equipped with three burners as it would make one less burner per boiler to be kept in repair. There is a possible disadvantage in reducing the number of burners, however, in that the four-burner furnace would permit one burner becoming inoperative without reducing the capacity of the boiler or necessitating the immediate installation of a good burner.

A curve showing the combined efficiency of boiler and economizer shows the tendency of the economizer to flatten out the efficiency curve at high loads. This largely compensates for the rapid decrease in boiler efficiency as the load is increased. In general, the economizer adds from 9 to 12% to the boiler efficiency and at the same time increases the boiler capacity approximately 12%.

After conducting the first ten tests on the boiler as originally installed, it was found that the loss in draft in passing over the rear baffle in front of the damper opening was .2" at 140% rating. This had the effect of reducing the available draft on the furnace and thus limiting the boiler output. It was therefore decided to remove the two top rows of rear baffle tile, leaving only one row above the damper opening. After making this change it was found that the available draft was greatly increased thereby making possible much higher loads on the boiler.

Fig. 1 shows the draft required at the damper for the various loads on the boiler after removing the two top rows of the rear baffle. From this curve it is seen that a definite draft is required for a given load on the boiler or for a given amount of oil burned per hour. It is rather surprising to note that the boiler can be operated up to 70% of rating with a positive pressure on the damper.

This positive relation between oil burned and draft required makes it possible to construct a meter which can be connected to the fuel oil lines to the burners, this meter being calibrated to show amount

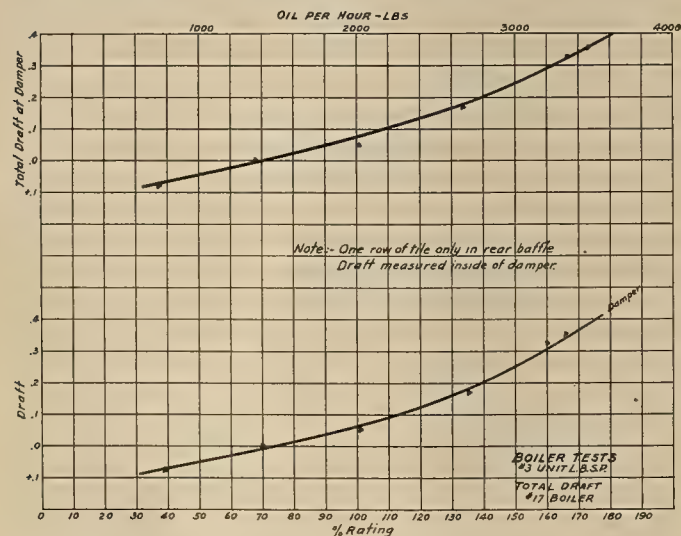


Fig. 1.—Curve showing draft required at the damper for the various loads on the boiler after removing the two top rows of the baffle.

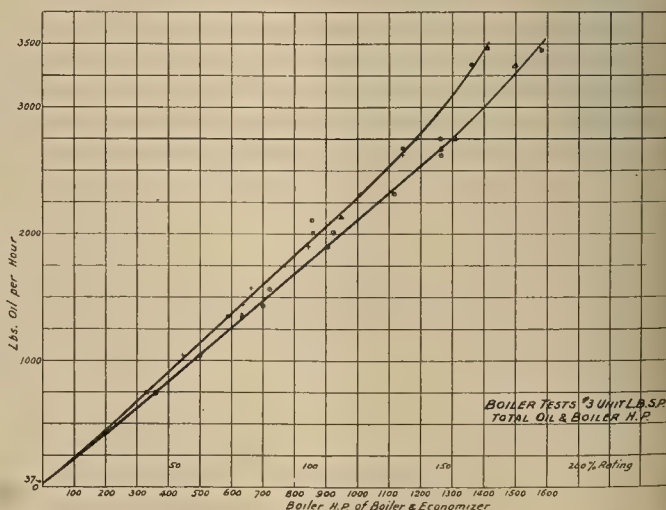


Fig. 2.—Curves showing oil burned for different loads on boiler and economizer.

of oil being burned per hour and also the draft required at the damper. An experimental meter of this sort was constructed and installed and from its operation it would appear that such a meter would be a great help to the fireman in enabling him to operate the boiler with the proper amount of draft. If such a meter were properly used it would undoubtedly result in the elimination of some of the boiler losses due to excessive draft and consequent increase in air supplied to the furnace.

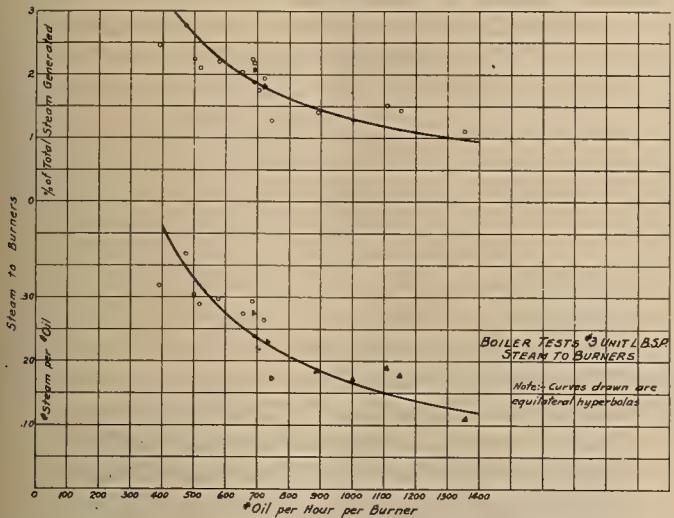


Fig. 3.—Curves showing the amount of steam per pound of oil fired in relation to the number of pounds of oil burned per hour per burner.

Oil Consumed —

Fig. 2 shows the oil burned for different loads on boiler and economizer. It is seen that these curves are practically a straight line passing through zero between 30% and 150% of rating on the boiler. This, therefore, indicates that the boiler operates at a practically constant efficiency between these loads.

This matter of constant efficiency over a wide range of load has a practical bearing on the operation of the plant in that it would enable the plant to be operated at light loads on several boilers. The boilers would then be ready to pick up additional load on short notice.

Steam to Burners —

The steam used by the burners was accurately measured by means of calibrated orifices, the difference in pressure across the orifices being measured by mercury U tubes. After making several attempts to find some relation between the steam required for atomization and oil burned or the load on the boiler, it finally appeared that the steam required was practically proportional to the number of burners operating.

Fig. 3 was therefore prepared to show the amount of steam per pound of oil fired in relation to the number of pounds of oil burned per hour per burner. The curve shown is an equilateral hyperbola which would represent a constant amount of steam used per burner regardless of the amount of oil burned. It is seen that the points approximately follow this curve. The amount of steam varies from .11 lb. to 1 lb. of oil, when the burner is handling

1400 lb. of oil per hour, to .4 lb. of steam to 1 lb. of oil with the burner handling 400 lb. of oil per hour. From this it is seen that a saving in steam for atomization could be effected by operating the boiler with a smaller number of burners.

Pressure Loss in Superheater —

In order to determine the pressure loss through the superheater a mercury U tube was connected across the two superheater headers and observations were taken at frequent intervals for one-hour periods. Fig. 4 shows the results of these tests and from

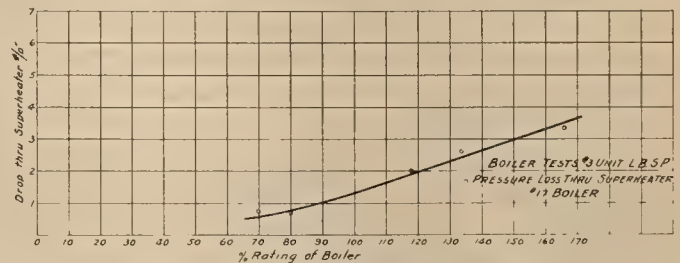


Fig. 4.—Showing results of tests to determine pressure loss through the superheater.

this curve it is seen that the drop across the superheater varies uniformly with the load on the boiler. The drop at 170% of rating was found to be only 3.6 lb. per square inch.

Varying Draft —

Four two-hour tests were made on one boiler operated at a constant load of about 105% of rating. In these tests the total draft at the damper was varied from zero to .3 lb., and the effect of this varying draft on CO₂ and stack temperatures was noted.

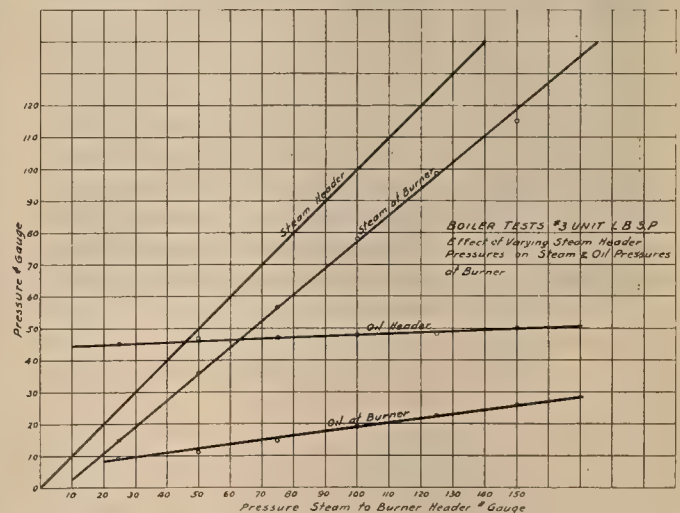


Fig. 5.—Showing results of tests with varying draft on a single boiler

Fig. 5 shows the results of these tests. From these curves it is seen that CO₂, which is an indication of the completeness of combustion, varies from 8.5% for the .32" draft to 14.7% for the .02" draft. From Fig. 1 we find that the draft required for 105% rating is .07"; this draft corresponds to 13.2% CO₂ from the curves on Sheet No. 8. The average of the CO₂ obtained on all of the tests for the boiler equipped with four burners was 14.0% and for the tests of the boiler equipped with three burners,

13.4%. It is therefore seen that the curve obtained for the tests on varying draft agree very closely with those obtained during the other tests.

It is also apparent from these tests that the excess air varies directly with the draft. The excess air under normal operation at this load should

amount to 20% corresponding to .07" draft. The excess air will, however, be increased to 80% by increasing the draft to .30". This gives a good indication of the unnecessary loss that would result from operating the boiler at drafts greater than those required to give proper combustion.

Automatic Substation, Sacramento Northern Railroad

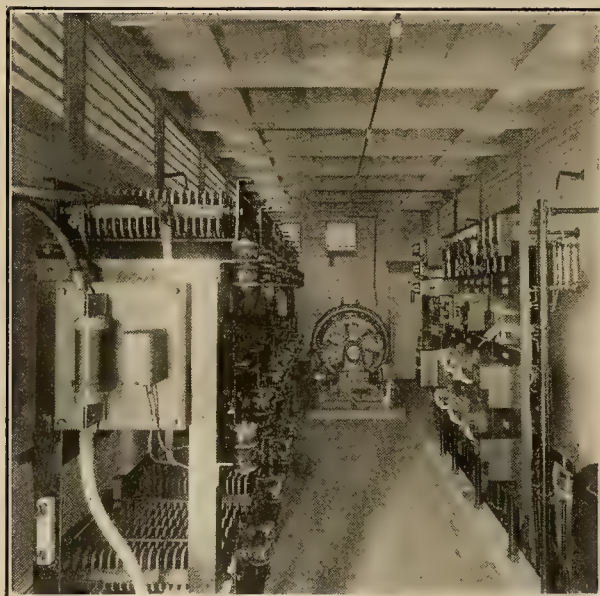
BY W. H. EVANS

(The electrical equipment of the portable automatic railroad substation described here is of interest not only to railroad engineers but also to electrical engineers in all branches of the profession as the use of automatic apparatus is becoming of widespread application. The author is electrical engineer for the Sacramento Northern Railroad.—The Editor.)

Although only the highest type of service can be well tolerated by any public service company, yet there must be certain definite economical relations maintained between the cost of service and the results gained. If the gain in service is not achieved economically the ends will be defeated. If a gain in service may be made with economy, that advantage will be taken. In the case in point, the Sacramento Northern Railroad had been operating its line with

300-kw., 600-volt, 60-cycle, 1200-r.p.m., 6-phase synchronous converter, a 240-kva., 2344/445-volt, oil-insulated, self-cooled, 3-phase transformer, together with the necessary automatic control equipment. All of this apparatus is installed in a box car constructed in our own shops from an 80,000-lb. capacity, 40-ft. flat car, with the necessary siding and roof added.

Energy is delivered to the railroad's portable substation at 2300 volts, 3-phase, from the power



Converter in background is equipped with flash barriers and motor operated brush lifters. Automatic control board to the right and series resistances to the left.



Transformer end of car showing arrangement of louvers to assist rapid cooling.

substations normally spaced ten miles apart. However, between Sacramento and the first substation north, there were fourteen miles and as the traffic was particularly heavy there the voltage conditions were not the best. The results were slow speed for both freight and passenger trains, and undue heating of motors.

General Features

To remedy this condition it was decided to install at a point about 5.6 miles north of Sacramento, a portable automatic substation which our figures showed could be installed for something less than \$19,000, whereas feeder cable to produce the same voltage regulation would have cost in excess of \$40,000.

The portable substation consists briefly of a

company's 60,000-volt to 2300-volt transformers which are located on a concrete platform which with the pole-top switches and fuses are located inside of a high wire fence for protection against trespassers.

Since the substation is automatic, normally the doors are always closed and locked, and in order to provide ventilation louvers were let into both sides and ends of the car; in addition screened openings are installed in the floor of the car for further ventilation.

Method of Operation

On account of the comparative newness of this type of equipment on the coast, a short description of the sequence of operations which takes place in automatically starting up and shutting down is given here.



SCHEMATIC WIRING PLAN OF AUTOMATIC SUBSTATION

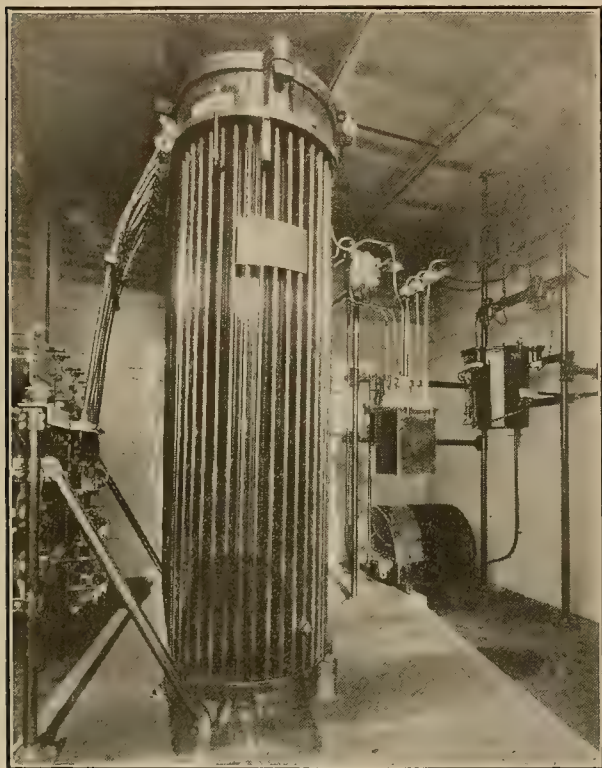
Starting of Station —

With the station shut down, and a train coming into the substation zone on either side, the third rail voltage is gradually lowered until it reaches the value at which the relays in the automatic substation are set which govern starting.

Relay 1 is a contact making voltmeter which is adjustable for any particular trolley voltage desired, in this case 500 volts. In connection with the overload relay 37, which functions to shut down the station, these two relays are the primary control in starting and stopping the station.

Relay one closes instantaneously when the voltage drops to 500 volts, short circuiting the coil of relay 2 which is a time-limit circuit-opening relay whose function is to provide a time delay in starting up the equipment as the low voltage conditions appear, as obviously simply a momentary swing below 500 volts should not be permitted to start up the station; the time setting of relay 2 can be adjusted to suit the particular conditions at any point.

The contacts of relay 2 are normally closed when the station is not running. When relay 1 operates, closing its contacts; relay 2, after a predetermined time, opens its con-



Near view of 240-kva. starting transformer, motor operated oil breaker and 5-kw. control transformer.

tacts and permits the coil of relay 3 to be energized. Relay 3 then closes its contacts and control current from the 5-kw. auxiliary-control transformer is admitted to the control circuits of the station. A circuit is then established from the a.c. control bus through the contacts of relay 27-X, the contacts of relays 3 and 26, operating coil of relay 4, auxiliary switch on circuit breaker and hand reset switch on oil switch motor mechanism back to control bus. The closing of contactor 4 establishes a circuit from the control bus through one of its contacts to segment 13 on the controller, then to segment 16 upper contact of auxiliary switch on brush raising device, and to the operating coil of contactor 6 and back to the control bus.

Operation of Controller —

Contactor 6 closes and starts the motor driving the controller which is very similar to the ordinary type K street-car controller. Through its various contact fingers and segments the controller performs the necessary sequence of operation of the various switches in starting up and shutting down the station, each succeeding step, however, being checked electrically by means of various relays to insure that the electrical and mechanical conditions have been properly fulfilled.

Segment 15 on the controller closes the operating coil of contactor 5 which establishes a circuit through one of its contacts to segment 1 on the controller and simultaneously completes a circuit from the same contact to the closing circuit of the oil-switch motor mechanism.

The oil-switch now closes, energizing the power transformer, and if the proper a.c. voltage exists on all three phases of the low tension side relays 32 close. These relays are so connected that no further operation can continue unless the proper phase voltage exists. Segment 14 on the controller then makes contact, completing a circuit through the auxiliary switch on the oil circuit breaker, one of the contacts and the operating coil of 5. This operation thus establishes a holding circuit for contactor 5 as soon as the controller advances beyond segment 15. Segment 2 on the controller then makes contact, completing a circuit through the contacts of the relay 32 and the operating coil of contactor 10.

Start of Converter —

The starting contactor 10 now closes, placing reduced voltage from the transformer upon the slip rings of the converter which starts. If the converter has come up to synchronous speed by the time the first gap in segment 16 is reached, a circuit is established from segment 14 through the contacts of 13 to segment 20 and thence to segment 18 and the operating coil of contactor 6. This holds contactor 6 closed until the gap in segment 16 is passed. If the converter has, however, not come up to speed by the time the gap in segment 16 is reached the circuit to the operating coil of contactor 6 is broken and the controller now comes to rest until synchronous speed on the converter is reached; i. e., until the speed control switch 13 has closed its contacts.

Segment 3 makes contact, closing the circuit to the operating coil of field contactor 31. This closes and connects the fields of the converter to the 250-volt exciter on the controller, thus fixing the proper polarity on the converter, and as the converter is brought to the proper polarity, the polarized relay 36 closes its contacts. Segment 3 then breaks contact, opening contactor 31.

Segment 4 makes contact energizing the operating coil of full-field contactor 14, which closes and places the field of the converter across its own armature for self-excitation. The field contactors 31 and 14 are mechanically interlocked so that 31 must open before 14 can close.

Running Conditions —

Segment 2 breaks contact, opening the starting contactor 10 and the segment 5 makes contact energizing the operating coil of running contactor 16 which closes and puts full a.c. voltage on the slip rings of the converter. At the same time relay 30 closes due to the establishment of full voltage across the armature of the converter.

Segment 26 makes contact, establishing a circuit through the upper contacts of the limit switch on the brush raising device and starts the motor of this device, thus lowering the brushes down upon the converter. If the brushes reach their lowest position, and the lower contact of the auxiliary switch on the brush raising device is closed, before the controller runs off the second gap in segment 16, a circuit is established from segment 17 through the lower auxiliary switch of the brush raising device to the operating coil of contactor 6, thus holding 6 closed and permitting the controller to continue to revolve. If the controller runs off segment 16 before the brushes are in their lowest position the operating coil circuit of 6 is opened and the controller stops until the lower auxiliary switch on the brush raising device closes and completes the circuit from segment 17 described above. The above steps insure that the brushes have been properly lowered upon the converter.

Segment 7 makes contact giving d.c. potential to segments 8, 9, 10 and 11. Segment 8 makes contact, establishing a circuit through the contacts of polarized relay 36, the contacts of relay 30, the electrical interlock on contactor 16 and the operating coil of contactor 18. Contactor 18 now closes, connecting the converter to the bus through all three sections of the load limiting resistance. The converter is then feeding the line through the 0.75 ohm series resistance.

Segment 9 makes contact establishing a circuit through the operating coil of contactor 21 and the contacts of relay 25 and, if the current demand is below the overload setting of relay 25 contactor 21 closes short circuiting section R-3 to R-4 of the resister.

Taking Load —

Segment 10 makes contact, establishing a circuit through the operating coil of contactor 20 and the contacts of relay

24 and if the current value is below the setting of this relay 20 closes, short circuiting the section R-2 to R-3 of the resistor. In a similar manner, segment 11, making contact, closes a circuit through the operating coil of 19 and the contacts of relay 23, thus cutting out the last section of resistance. The machine is now connected directly to the bus and delivering load. During the last several operations mentioned above after contactor 18 closed, the contacts of relay 37 open, inserting the section BC of the resistance in series with the contact making voltmeter 1. Simultaneously the voltage on the bus has been brought up to normal but the contacts of the voltmeter still remain closed due to the resistance BC which has just been inserted.

Segment 17 breaks contact opening the circuit previously established through the lower contacts of the brush raising device and the operating coil of contactor 6 which latter opens and the controller comes to rest at the running position, being stopped immediately by its solenoid brake.

Shutting Down —

When the load demand decreases and reaches the setting of relay 37 which in this case is adjusted for 100 amperes, the contacts of the latter close short circuiting section BC of the resistance in the coil of the contact making voltmeter 1 causing the voltmeter to open its contacts. This removes the short circuit from coil of 2 closing its contacts instantaneously and short circuiting coil of relay 3 which starts to open its contacts. If the load does not increase long enough for 2 to reset at any time during the setting of the dash-pot on relay 3, the latter's contacts open, interrupting the circuit of contactor 4. Should the load increase before contacts 3 have opened, 37 would open, inserting resistance section BC and causing the voltmeter to make contact. The voltmeter contacts short circuit coil of relay 2. Contacts of relay 2 open after time-delay and re-energize 3.

After 3 has opened, contactor 4 opens, interrupting two circuits simultaneously; the first being the a.c. supply to controller segment 13 and the other the d.c. circuit including the operating coil of contactor 18. The holding circuit for contactor 5 through segment 14, the auxiliary switch on the oil circuit breaker and the contacts of 29, are broken and line contactor 18 and control contactor 5 now open.

The opening of contactor 5 interrupts the supply to segment 1 on the controller and establishes a circuit through its electrical interlock to segment 19. Contactors 16 and 14 open disconnecting the converter from the transformer and discharging its field which in turn drops relay 30 out.

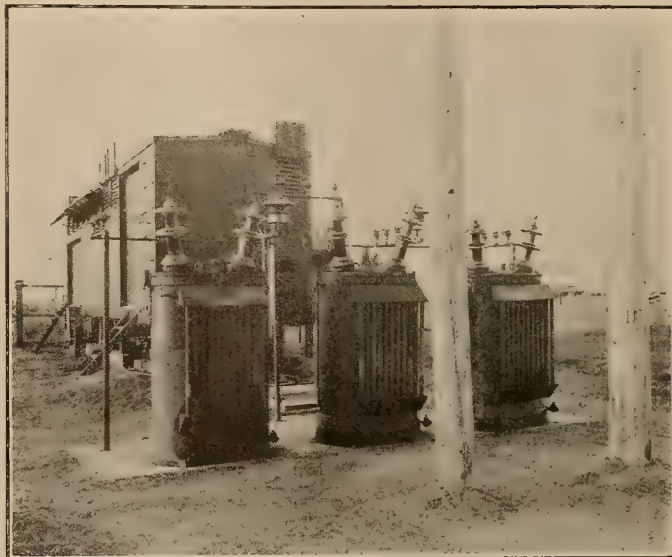
The operating coil of contactor 6 is then energized through the electrical interlock on contactor 5 and segments 19 and 18. The controller motor starts and contactors 19, 20 and 21 open. Segment 24 makes contact energizing the trip circuit of the oil switch mechanism; also segment 25 makes contact through the lower limit-switch on the brush-raising device. The high tension line is now disconnected from the transformer de-energizing relays 32 which open, and the brushes are raised from the commutator. Segments 18 and 19 break contact, and the controller comes to rest at the off position. In the meantime the motor of the brush raising device continues to operate until reaching the end of its travel when the lower limit switch is opened, breaking the supply to the motor. As the voltage on the converter armature dies down after contactors 14 and 16 are open, relay 30 also opens, and the station is completely shut down.

Protective Features —

D.C. Overload.—Relays 23, 24 and 25 are calibrated at a.c. loads corresponding to d.c. loads of 900, 1200 and 1500 amperes and upon reaching these successive loads the series resistances of 0.15 ohms, 0.25 ohms and 0.35 ohms are inserted in circuit with the converter, causing a reduction in the trolley voltage supplied to the third rail and consequently reducing the ampere output of the machine.

A.C. Overload.—Should trouble develop on the d.c. side of the converter inside the connection of the load limiting resistance, relays 26 are energized from the current transformer on the low tension side and will open after a set time and shut down the equipment. Relays 26 are set at a higher value than relays 23, 24 and 25 and are also time-limit opening. This time-limit feature allows momentary swings to occur without shutting the machine down. In our case these relays 25, 24 and 23 are instantaneous circuit opening and time-limit circuit closing being adjusted to close at 3 seconds and at 16 seconds after the current has fallen to a certain value for each relay. This time delay permits of the acceleration at a low voltage of heavy trains which when starting up cause the resistance to come in, and when the trains have accelerated and the current demand fallen off, the time setting permits of their receiving full voltage at the end of their accelerated period.

Additional a.c. protection is provided by relay 28 which is energized from a current transformer in the high tension winding and is set considerably higher than the other overload devices. When this relay operates, the oil circuit breaker is tripped open and with it the hand-reset switch thus completely shutting down the station. The opening of the hand-reset switch interrupts the coil circuit of contactor 4 and simultaneously with it the opening of the auxiliary switch on the oil circuit breaker interrupts the holding circuit of contactor 5. The operation of either of these devices shuts down the equipment. After the oil circuit breaker has been tripped in the above manner and the hand reset switch opened, the station will not start up again until the hand reset switch is



60,000 to 2300-volt transformers provided with external, separate pipes for natural cooling of oil are an unusual design.

closed by the inspector. Consequently relays 28 are set very high and are expected to operate only in cases of severe trouble where the attention of an inspector would be necessary.

Low Voltage.—Relay 27 provides the a.c. low voltage protection. When low voltage occurs, the left hand contacts of 27 are closed, short circuiting the coil of 27-X, opening it and interrupting the supply through the contacts of relay 3 to the coil of contactor 4. Relay 29, in a certain sense, performs the functions of an a.c. low-voltage relay whenever the converter is running, since, should the a.c. voltage fall too much, the converter would invert and supply power from the trolley to the a.c. system. Reverse-current relay 29 would then open, interrupting the holding circuit of contactor 5, shutting down the machine.

Over Speed.—Speed limit device 12 on overspeed closes the circuit of the shunt trip of the d.c. circuit breaker. When this opens, the auxiliary switch on the circuit breaker interrupts the supply to the coil of contactor 4 and the equipment shuts down. When this happens it must be hand reset by the inspector.

Under Speed.—The speed control switch 13 is a centrifugal device, the contacts of which remain open until approximate synchronism is reached.

Sequence.—The sequence of events is fixed primarily by the controller but in addition to this there are electrical interlocks on contactors 5 and 16, as well as the holding circuit of contactor 5, all of which are additional safeguards against incorrect sequence.

Polarity.—The 250-volt excitation generator, direct-connected to the motor of the controller, fixes the polarity of the converter, but as an additional precaution the polarized relay 36 must be energized in the proper direction before allowing line-contactor 18 to close.

Temperature.—Should the load-limiting resistance or bearings overheat the thermostats will open de-energizing relay 27 which, when de-energized, closes the left hand contacts of 27 thus shutting the equipment down. The thermostats over the resistor are self-resetting when the resistor cools off, while those on the bearings of the converter are hand reset and require the attention of the inspector before the converter will again start.

A thermal relay is provided whose rise in temperature is proportional to the heating in the converter winding and

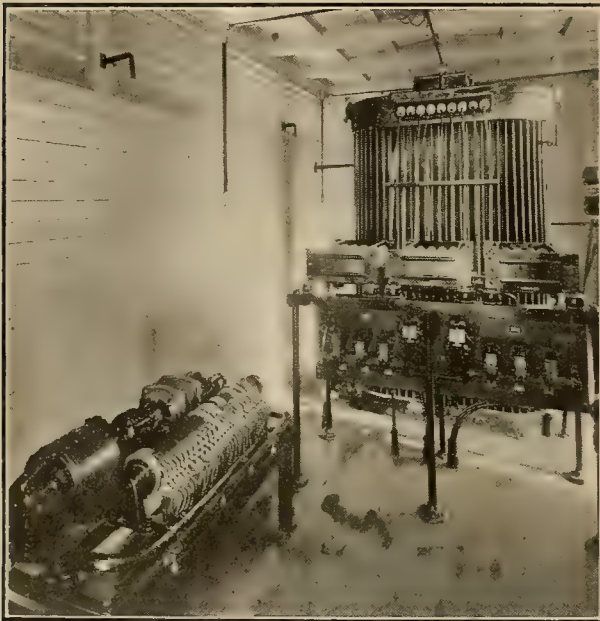
in case of a long continued overload which would injure the insulation, this relay operates and shuts the station down. This relay in one of the illustrations is shown mounted on a small panel supported on the resistor grid iron framework.

The thermal element is the fuse like object connected in one phase of the converter transformer, secondary. A small tube containing a volatile liquid connects from the thermal element to the relay on the right—the expansion of the liquid under heat actuating the relay whose contacts when opened, interrupt the circuit to relay 27 and shut the station down.

Balanced Polyphase Voltage.—This protection is provided on the low tension side of the power transformer by means of the two relays 32 which are connected across different phases. All three phases of the power transformer must be excited to approximately normal voltage or otherwise one or both of these relays will remain open and prevent the starting contactor 10 from closing.

Position of Converter Brushes.—Proper position of these brushes is assured by means of the auxiliary switch on the brush raising device.

The converter is equipped with flash barriers which completely surround the brush holders and in case of an attempted flash-over between brushes the hot metallic vapors are



Starting grids, running contactors and motor operated drum controller.

scopped up from the commutator and dissipated in two sections of wire mesh. The system is subjected to frequent short circuits between the third rail and traffic rail, owing to sectionmen dropping tamping bars across the conductor rail, and from various other causes, so that flashovers on the commutator of the motor generator sets have been quite frequent and severe. These flash-overs were usually accompanied by a spill-over to the pedestals of the machines and it has been found necessary to remove the grounds from the machine frames in order to reduce this spilling-over. There has been during five months' operation of the automatic substation, what was evidently a severe short circuit on the third rail in the immediate vicinity of the substation; the flash barriers no doubt took care of the resulting flash-over at the commutator, some of the flash-screen metal having been vaporized, but the substation cleared itself and when the writer visited the station that day the machine was carrying 50% overload without any evidence of the flash-over having inconvenienced the converter as far as normal operation was concerned. It was evident, however, that a spill-over had taken place to the pedestal of the machine. These spill-overs are believed to be due to the inductive kick occasioned by the sudden extreme variation in current in the third rail, the magnetic effect of which accentuates the short circuit conditions on the machine commutators. In addition to removing the ground from the machine frame an electrolytic lightning arrester has been connected between the positive of the machine and the traffic rail with the belief that the arrester will take care of any extreme inductive kick occurring across the converter armature, the fields, or the series resistors of the machine.

General Results of Operation

Our experience so far with the automatic control seems to show that this type of equipment is particularly advantageous for interurban service. The cushion of resistance which is introduced in extremely heavy demands results in much better operation than the manually operated stations, in that improper handling by a motorman of his train, or in case of two or more trains pulling on a station, does not result in opening the station breaker, with the resultant slowing down of trains and probability of again pulling the breaker when the station operator closes his switches. With automatic control, there is no breaker to open. The station simply cuts in the proper resistance which should have been cut in on the train by the motorman if he had handled his train properly. The voltage to the train is thereby cut down and a lower current demand follows; but in the meantime the train continues to accelerate under this reduced current and in a few seconds the amperage falls to a value which allows the resistance contactors to again close, short circuiting the resistors and delivering full voltage to the trains.

This method of operation naturally results in better conditions as regards flashing at commutators of car equipment due to poor handling of trains as the station resistance automatically takes care of any such defective train operation. For those interurban lines which operate heavy freight trains the automatic control with the current limiting resistors and particularly in combination with a 200% overload characteristic in the converter or motor generator set, is particularly fitted for handling this class of service.

Improved Operation

In addition to the large saving in operators' wages which the automatic control gives, it also provides a considerable saving in eliminating idle running of a substation, with its attendant running-light losses. Substation operators are instructed to cut in or off the line either at defined time intervals or upon certain current and voltage indications upon their station instruments, but we are aware that even under these regulations there is a very considerable amount of idle running. Under automatic control, however, running-light losses are cut to a minimum as the station does not start except upon a predetermined demand for power and then shuts down when this demand no longer exists. The greater the interval between trains, the larger will be the saving of energy obtained through the elimination of running-light losses. The use of automatic control therefore reduces both of the predominant items in the total cost of power; i. e., the energy charge itself and the item of substation wages. Our equipment is adjusted so that approximately three minutes after the demand for power falls below 100 amperes, the station shuts down, this three-minute interval in our case being sufficient to take care of the time consumed by a train in the substation zone, coasting, braking, and stopping. The station delivers current to the line thirty seconds after relay 3 closes, or about thirty-five seconds after the demand for current oc-

curs, there being about a five-seconds delay in the action of the relay 2 to provide against momentary swings bringing the station into action.

Trouble Experienced

This station will be regularly inspected at intervals of about every four or five days, this being done at present by an extra operator who also spends part of his time in line work and affording relief to other station operators. To date the equipment has been remarkably free from trouble, our main difficulty having been from loose contacts at terminals of relays which had not been thoroughly tightened up and were shaken loose by the vibration of the car. These only resulted in shutting the station down, and since going over all these contacts thoroughly there has been no further difficulty.

In addition to this unit the railroad has recently ordered another similar equipment to be installed at another point on the system where present substation spacing is also too great and voltage conditions poor. This additional equipment includes a converter with high reluctance poles which is expected to be practically free from all flash-overs incident to shorts on third rail. Curve drawing meters will be provided so as to give us a record of what is taking place in the station. In addition the relays 23, 24 and 25 will be controlled from d.c. shunts instead of from a.c. current transformers, thus providing an easier means of adjusting the relay settings. Thermal relay protection will be obtained from current transformers on the a.c. side instead of being on the d.c. side as in the present installation.

The company has in operation nine manually operated stations, in four of which the apparatus is located in a building, and in the other five is of a portable nature similar to the automatic equipment. It is planned to provide all of these nine stations with automatic control and probably take advantage of the portable nature of five of them to shift their relative locations so as to provide better regulation over the system.

This unit was completely installed at a cost of approximately \$18,500 including the electrical apparatus, the car in which it is installed, the protection fence, concrete platform for power transformers, and spur track on which the car is mounted. This cost does not include the cost of the 60,000/2300-volt transformers and open-air type switching equipment which the power company provided.

The electrical apparatus used in this automatic substation was designed and manufactured by the General Electric Company of Schenectady, New York.

A NEW SCHOOL OF ENGINEERING

BY WALTER HAYNES

The Department of Education of the Portland Y. M. C. A. has established a school which aims to accommodate students who for some reason are unable to take a regular college engineering course. It was found, by paring down the college course of all cultural subjects, that three years were sufficient to cover a technical electrical engineering course. This course admitted men who had had algebra in the high schools. Such high school subjects as trig-



The laboratory of the electrical engineering school is so completely equipped as to rank well with any first-class electrical engineering laboratory

onometry, physics, chemistry, and English were given as well as subjects strictly along the line of electrical engineering. An abbreviated course in mathematics, with special emphasis upon engineering applications, enabled the students to handle any and all problems which are usually submitted to an engineer. This covers the regular engineering course from algebra to integral calculus, inclusive, except that plane and solid geometry are very much abbreviated. Subdivisions of mathematics, which are included in texts for the sake of completeness, are eliminated.

Considerable attention is given to the writing of engineering reports. The students are required to write a minimum of 150 reports, each one of which, in addition to being a technical paper, is an exercise in English composition. Three years of this instruction seldom fails to teach the student to write a direct, concise, and clear-cut report upon any assigned engineering subject.

There are certain physical and mental limitations inherent in the human make-up. One of these is the inability to retain a high percentage of the subject matter of a given course, when a large number of other dissociated subjects are pursued simultaneously. For this reason, students taking this "abridged" course are probably better trained, and remember a larger portion of the strictly engineering subjects than graduates of engineering colleges. This conclusion is based upon the grades received in competitive civil service examinations with graduates of other colleges, and with their comparative value in engineering work.

JOURNAL OF ELECTRICITY INDEX

Those desiring copies of the Journal of Electricity Index from January to June, 1920, may obtain them by sending request to the Circulation Manager.

SPARKS—Current Facts, Figures and Fancy

(On this page you are told how to eliminate the danger of broken windshields, how to expedite the erection of telephone poles and how to build an attractive house of common earth. Concise and valuable information is also given regarding the largest cheese in the world and the latest in bridal functions as well as bits of data on the electric utilities of California and the electrification of Swiss railroads.—The Editor.)

There are 121 families for every 100 dwellings in this country.

* * *

There are 84 electric utilities in the state of California, operating 75 hydroelectric plants and 50 steam plants.

* * *

Vast deposits of potash are reported as having been discovered in Morocco, valued at two hundred million dollars.

* * *

An inventor has mounted an electric flashlight in the frame of a note book for the use of persons who are obliged to continually work in the dark.

* * *

The latest in bridal functions occurred in a northwestern city recently when a popular bride-to-be was given an elaborate electrical bridal shower.

* * *

Recruits are joining the British army at the rate of 200 per day and many of the men whose period of service was about to expire have re-enlisted.

* * *

In purchasing flour today one finds that the pre-war dollar is worth \$0.41, in purchasing sugar that it is worth \$0.29, and in purchasing potatoes that it is worth a mere \$0.22.

* * *

In parts of China the Standard Oil can is the standard of measurement. The liquid treasure that has gone across the Pacific and Atlantic oceans in Standard Oil vessels exceeds \$100,000,000 in value.

* * *

The government of Switzerland has announced an offering of \$25,000,000 twenty-year 8 per cent sinking fund gold bonds to provide funds for the electrification of the government railway system of that country.

* * *

The avoirdupois English pound now in use was derived from the weight of 7,000 grains of wheat taken from the middle of the ears and well dried. This was established as the standard pound during the reign of Queen Elizabeth and has continued to the present day.

* * *

All alteration and remodeling work has been stopped on buildings in London because all labor and materials are urgently needed for the construction of new dwellings. It is estimated that an effective house building campaign in London will require at least 45,000 skilled bricklayers. In all England there are now only 50,000 bricklayers as compared with 100,000 before the war.

The biggest cheese in the world was recently brought into being as the result of a day's work on the part of twelve thousand cows. This was sent from California to the National Dairy Show in Chicago. It weighed 357,000 pounds, was eight feet high, and 10½ feet in diameter.

* * *

The first pumping engine made for sale, which dates from 1766 and is preserved near Birmingham, England, was put to a trial under steam recently. The engine was in continuous use for more than half a century. Designed for 13 strokes to the minute, the ancient piece of machinery maintained 16 strokes to the minute at the trial.

* * *

A Silent Guide which is being placed in one of the stations of a London tube labyrinth consists of a map surrounded by numerous plates carrying the names of all stations in the tube. The traveller presses a knob opposite the name of his destination and lights of different colors on the map indicate "where you are," "when to change," and "the place you want."

* * *

The danger of breaking windshields and car windows will be greatly reduced by the use of laminated glass which consists of two sheets of ordinary glass between which is interposed a thin sheet of pyroxylin plastic. These are welded together by hydraulic pressure and the application of the proper degree of heat. The pyroxylin binder prevents any scattering of fragments in the event of violent breakage.


* * *

Architects are suggesting that the high cost of home building in America be reduced by the use of a compressed earth. Clayey and somewhat sandy loam are mixed with straw or hay to prevent cracking. The wall is built in sections by means of a movable frame into which the moist earth is rammed or beaten in four-inch layers. The outer surface of this so-called wall can be color-washed or treated in various ways.

* * *

The tedious process of erecting telephone poles is being greatly expedited through the use of a combination tractor and earth-boring machine which digs the hole and sets the pole in about eight minutes. The boring machine is, in reality, a giant augur which will bore a hole in the ground any size from 2 to 30 inches in diameter, and as deep as 8 feet. When the hole is bored, the steel tower in which the augur is contained is used as a crane to lift the pole and set it in position.

PERSONALS



H. F. Jackson, formerly vice-president and assistant general manager of the Pacific Gas & Electric Company, has resigned his position with that company to become general manager of the Great Western Power Company. Mr. Jackson was formerly president and general manager of the Sierra & San Francisco Power Company, and then when that company's properties were taken over by the Pacific Gas & Electric Company, remained with them until the transfer had been consummated. Mr. Jackson has recently returned from the

East where he had been engaged in the sale of some of the bonds of the Sierra and San Francisco Power Company.

Glen E. Arbogast, F. E. Newbery Company, Los Angeles, was a recent visitor in San Francisco.

H. M. Littell of the Southern California Edison Company, Los Angeles, is visiting in San Francisco.

H. L. Hallis, electrical engineer of Chicago, was in San Francisco recently on a combined business and pleasure trip.

P. D. Callahan, representing the Farries Manufacturing Company, Decatur, Illinois, visited Seattle recently on his way east.

Geo. A. Campbell, president of the Reno Gas and Electric Company of Reno, Nevada, visited in San Francisco last week.

H. E. Barre, electrical engineer, Southern California Edison Company, has been away from Los Angeles on a business trip to San Francisco.

F. L. Hutchinson, secretary of the A. I. E. E., stopped in San Francisco last week on his regular tour of inspection of the various sections.

G. A. Girder has taken over the business of Noble D. Powell in Stockton and contemplates extensive changes in the arrangement of the store.

George Boring, district manager, Pacific States Electric Company, Portland, spent several days in Seattle in the early part of July while en route to Spokane.

A. Emory Wishon, assistant general manager of the San Joaquin Light & Power Corporation, was a recent visitor to San Francisco on business for his company.

A. N. Kemp, vice-president of the Southern California Edison Company, is making an extended trip in the East, his itinerary including New York and Chicago.

Earl Wilson, contractor-dealer of Napa, has moved into a new store which is one of the best equipped and most modern stores of its kind in northern California.

H. E. Sanderson, Pacific Coast manager of the Bryant Electric Company, has returned recently from a trip to the northwest cities of Portland, Seattle and Tacoma.

H. H. Courtright, Valley Electric Supply Company, Fresno, recently visited San Francisco to attend a meeting of the committee on the revision of the safety code.

L. S. Ready, assistant chief engineer of the California Railroad Commission, has recently returned from the A. I. E. E. convention at White Sulphur Springs, West Virginia.

I. E. Artz, manager of the industrial department of the Westinghouse Electric & Manufacturing Company, East Pittsburgh, has been visiting in San Francisco during the past two weeks.

G. H. Hagar, formerly with the Vallejo Light and Power Company, has been appointed assistant division superintendent with the Great Western Power Company and is now located at Napa.

I. A. Rosok, general superintendent of the Bisbee Improvement Company, has just completed a trip through the West, stopping in the Yellowstone Park, San Francisco and Los Angeles.

H. P. Cramer, who has been motor sales engineer with the General Electric Company at Portland for a number of years, has accepted a position as manager with the Robert Skeen Electric Works.

R. M. Alvord, local manager supply department, General Electric Company, San Francisco, has been in Schenectady on business. He intends to return to San Francisco about the first of August.

R. E. Eltringham, electrical engineer, California Industrial Accident Commission, has spent two weeks in southern California arranging for the formation of a new branch of the commission in that territory.

R. C. Starr, construction engineer of the San Joaquin Light & Power Corporation, who has been in charge of the Kerckhoff project, is to be congratulated on the completion of the tunnel last week which was put through in record time.

L. D. Canfield, assistant service manager at the New York office of the Westinghouse Electric & Manufacturing Company, was appointed district service manager to succeed **L. G. Richards**, who has been transferred to East Pittsburgh.

D. E. Harris, sales manager of the Pacific States Electric Company, recently visited Chicago on a business trip but returned to San Francisco in time to attend the Electric Supply Jobbers' convention at Del Monte on the twenty-ninth of July.

J. E. Woodbridge, electrical engineer with Ford, Bacon and Davis, has returned to San Francisco after a hurried business trip to the East. Mr. Woodbridge returned over the Chicago, Milwaukee and St. Paul Railroad in order to inspect this system.

S. I. Crookes, Jr., electrical engineer from New Zealand, has spent a month recently on the Pacific Coast inspecting the large power developments now under way. Mr. Crookes is connected with the firm of S. I. Crookes and Son, consulting engineers of Auckland, New Zealand.

E. R. Stauffacher, protection engineer, Southern California Edison Company, is attending the Pacific Coast Convention of the A. I. E. E. at Portland and after the convention will go to Montana to inspect the protective system of the Montana Power Company. This system is said to be one of the most complete in the United States.

Stacey Hamilton, statistical engineer for the Portland Railway, Light and Power Company, has recently been ap-

pointed organization inspector reporting directly to President Griffith. His new duties will include the making of special inspections, investigations and reports to the president pertaining to the various departments and operating details of the company. Mr. Hamilton has been connected with the Portland Railway, Light and Power Company for some time, and took a very active part in the gathering of the data which

made up the Water Power Development Report presented at the recent convention of the National Electric Light Association.



Frederick A. Anderson has recently been promoted to senior electrical engineer, United States Shipping Board, Southern Pacific District. Mr. Anderson has been connected with the electrical industry since 1889 when he was connected with the Sprague Electric Railway, and later designed and installed many industrial plants. In 1901 he accepted a position with the engineering department of the United States Army and was sent to a number of the sea coast forts on the Atlantic Coast in charge of the electrical and mechanical installations.



In 1916 he left the services of the government to take up commercial electrical welding but at the outbreak of the war was called into the government services again in the electrical division of the Bureau of Steam Engineering of the Navy Department. Later Mr. Anderson was called to the service of the Shipping Board, being electrical engineer at Hog Island, from where he was transferred to San Francisco as electrical inspector of the Southern Pacific District.

Willard C. Johnson, industrial engineer, Westinghouse Electric & Manufacturing Company, has left San Francisco for Honolulu. Mr. Johnson expects to be away for about three months and while in Honolulu will look after the interests of the Westinghouse Company in that place.

B. J. Holt, of Woodland, whose name is familiar to the readers of the Journal of Electricity on account of his success as an appliance salesman, has gone to San Francisco. Mr. Holt will conduct an appliance selling campaign for the Schwartz Electric Company of San Francisco.

N. J. Sinnott, chairman of the public lands committee of the state of Oregon, accompanied the party made up of the Idaho congressional committee on appropriations and other federal and state officials which visited some of the more notable sites of the Minidoka irrigation project of that state, last week.

Col. E. E. Winslow, United States Army, in charge of rivers and harbors in California, has been inspecting conditions at Lake Tahoe in connection with the application to cut the rim of the lake and use its waters for power purposes. Col. Winslow will hold a hearing at Reno after his investigation and will inspect the power plants which derive their water from the lake.

W. R. Wallace, **W. W. Armstrong** and **G. F. McGonagle**, Utah state engineers, attended the meeting of the Utah Water Storage Association which took place in Salt Lake City last week. At this time pertinent discussion took place concerning the construction of a reservoir, on the Hailstone site, which will hold about 40,000 acre-feet of water with a dam from 100 to 125 feet high.

A. D. Church, for the past few years district manager for the Midland Counties Light & Power Company, with headquarters in San Luis, has been transferred to the Santa Maria district to take the place of Mr. Ten Eyck, who has returned to college to finish a special course. Charles J. Kelly of the Coalinga district of the company has been transferred to the San Luis district.

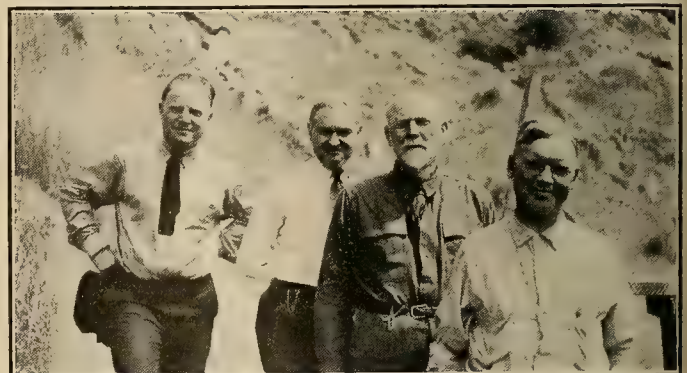
Lt.-Col. B. O. Clupek of the Czechoslovak army has been inspecting the various hydroelectric developments in California for the past two weeks. Col. Clupek is here in the interests of the newly formed republic of Czechoslovakia and from San Francisco will go to New York by way of Portland, Seattle, Spokane and Butte, inspecting the water-power developments of the northwest en route.

F. R. Fishback, sales manager of the Electric Controller & Manufacturing Company of Cleveland, Ohio, accompanied by Mrs. Fishback, is making an extended trip through the West. He expresses himself as well pleased with the business outlook reported by his Western representatives.

G. J. Walton, local manager with the California-Oregon Power Company at Klamath Falls, Oregon, has tendered his resignation, effective August 1st. He is one of four men still with the company who were in its service when he entered in 1906. Mr. Walton's place will be filled by **J. C. Thompson** of San Francisco, the present general secretary of the corporation. Mr. Walton will engage in private business.

S. E. Bretherton, Jr., has taken over the business of the Scott Electric Company in Atascadero, California, buying out **W. E. Scott** with whom he was in partnership. Mr. Scott is to locate in the San Joaquin valley and will open up a modern shop in the vicinity of Fresno. Mr. Bretherton recently made a business trip to San Francisco in connection with the new installation of a fire alarm system for the colony of Atascadero.

W. T. Batcheller, electrical engineer with the Seattle Municipal Light and Power System and secretary-treasurer of the Seattle Section A. I. E. E., has just returned from the East where he attended the 36th Annual Convention which was held in White Sulphur Springs, West Virginia, June 29-July 2. Mr. Batcheller recently passed through San Francisco on his way to the Pacific Coast A. I. E. E. convention in Portland.



The picture above was taken during a recent trip over the system of the Southern California Edison Company, and that of the San Joaquin Light and Power Corporation. From left to right are, **I. W. Alexander**, Manager Bond Sales Department of the San Joaquin Light and Power Corporation, **D. H. Braymer**, Managing Editor Electrical World, **James H. McGraw**, President of the McGraw-Hill Company, Inc., and **H. R. Stevens**, superintendent of construction with the San Joaquin Light and Power Corporation.

OBITUARY

George A. Woolley, district manager of the General Electric Company, Denver, for the past five years and an employe of the General Electric Company for thirty years, has recently died.

E. H. Mulligan, district manager for the Southern California Edison Company at Redlands, died on the afternoon of July 12 following an illness of several months' duration. Mr. Mulligan served as district manager for the Edison Company for twelve years in the Pasadena district and was transferred to Redlands in 1919. In the eighties he was sent to Antwerp, Belgium, as a representative of the Bell telephone interests, introducing American phones in that country. Later he was a conspicuous figure in the pioneering work in electrical generation in California and a member of the "Edison family" from 1908.

It is with deep regret that we record the death, on July 26th, of **Mrs. Henry Bostwick**, wife of **Henry Bostwick** of the Pacific Gas & Electric Company. The electrical industry, in which she had so many friends, learns of her death with a real sense of personal loss.

Meeting Notices for Electrical Men

(Plans for the advancement of the cooperative campaign idea in all parts of the West are numerous among the following meeting notices. Accounts of the organization of the A. A. of E. chapters of California, of the Illuminating Engineering Society election and of an Electrical Table at the Portland Chamber of Commerce also appear on these pages.—The Editor.)

Plans of the Northwest for a Cooperative Campaign

The advisory committee of the Northwest Electric Light and Power Association met in Seattle on July the fifteenth and sixteenth. At this time a plan for establishing an electrical cooperative campaign in Washington, Oregon, Utah, Idaho and Montana, was discussed. The matter will be presented at the annual meeting of the Association which is to be held in Spokane, September 8 to 11, and at this time a definite plan similar to that already in operation in California will probably be adopted.

The advisory committee of the Northwest Electric Light and Power Association is made up of fifteen men who represent every branch of the electrical industry.

Members of the committee who represent the central stations are R. W. Clark, chairman, Puget Sound Light & Power Company, Seattle; A. G. McMicken, Portland Railway, Light & Power Company; G. A. Lewis, Washington Water Power Company, Spokane; J. V. Strange, Pacific Power & Light Company, Salt Lake City; J. Ryan Gaul, Montana Power Company, Butte; W. R. Putnam, Idaho Power Company, Boise.

Those representing the jobbers are G. W. Hawley, Intermountain Electric Company, Salt Lake City; J. I. Colwell, Western Electric Company, Seattle; H. L. Bargion, Montana Electric Company, Butte; R. N. Averill, Fobes Supply Company, Portland.

The contractor-dealers belonging to this committee are R. G. McKenny, NePage-McKenny Company, Portland; J. R. Tomlinson, Pierce-Tomlinson Electric Company, Portland; J. F. NePage, NePage-McKenny Company, Seattle; W. M. Meacham, Meacham & Babcock, Seattle.

Result of Advisory Committee Meeting

At a recent meeting the Advisory Committee of the California Electrical Cooperative Campaign decided to undertake educational work on industrial lighting. This work will be built around two exhibits, one to be located in San Francisco, and the other in Los Angeles. These exhibits will be modeled after the industrial lighting exhibit that was shown at the National Electric Light Association convention at Pasadena. Two committees of the Advisory Committee are planning these exhibits at the present time, one committee working in Los Angeles and the other in San Francisco. These exhibits will be in charge of Mr. Spring and Capt. Smith, who will give lectures on industrial lighting in addition to their other duties.

In conjunction with the educational campaign that is being carried on on adequate convenience outlets, the Advisory Committee is having prepared a series of ten stories and illustrations for the newspapers and is taking orders through the field men for the N. E. L. A. booklet, "The Modern Home," as well as for large and small copies of modern electrical home plan number two.

State Organization of the A. A. of E.

The California Chapters of the American Association of Engineers have just completed the formation of a state organization.

The name of this organization is The California Assembly of the American Association of Engineers. It consists of one delegate from each Chapter in the state. The officers elected are: T. E. Stanton of Sacramento, president; Burdette E. Moody of Los Angeles, vice-president; Ralph E. Dodge, San Francisco, secretary-treasurer. The other delegates are: I. H. Tielman, Fresno; Arthur H. Adams, Long Beach; George S. Hinckley, Redlands; Thomas H. King, San Diego.

The State Assembly of the American Association of Engineers will handle all A. A. E. matters of state-wide importance or those concerning matters of interest to several Chapters. It will also co-

ordinate the work of the different state Chapters and will cooperate with other technical and civic organizations in advancing matters of mutual interest. California, Oregon and Washington now have A. A. E. state organization. California is the third state of the Union in point of A. A. E. membership.

New Officers of the Illuminating Engineering Society

The officers of the Council of the Illuminating Engineering Society for the fiscal year 1920-1921 have been elected and confirmed by the Council and will assume office on October first. They are as follows: George H. Harries, president; H. F. Wallace, Geo. S. Crampton and J. J. Kirk, vice-presidents; Clarence L. Law, general secretary; L. B. Marks, treasurer; Adolph Hertz, Walton Forstall and Frank S. Price, directors.

Salt Lake City Commercial Club

Former Governor, William Spry, the principal speaker at a recent luncheon of the Salt Lake City Commercial Club, emphasized the necessity of a "back to the soil" movement, and stressed the necessity of educating Congress to understand more clearly the importance of reclamation work, by explaining that the reclamation act of eighteen years ago had only been secured after five years of hard work, and that in those eighteen years only \$110,000,000 had been appropriated, of which Utah had received only \$3,500,000.

As illustrating the recompense which comes from the proper investment of money in reclamation projects, Mr. Spry said that on the Strawberry project alone the increased product per acre last year had paid the amount expended for water. He also cited how the Twin Falls, Idaho, project had, at its inception, but six families, while it now contained 60,000 persons, adding that in 1918 the Oregon Short Line had hauled away \$40,000,000 in products, after all the vast amount necessary for the sustenance of the inhabitants had been deducted.

BUILDERS OF THE WEST — LXXXII



JAMES A. B. SCHERER

In keeping with the magnitude of engineering achievement which has marked the development of the West, the engineering schools and university departments of the Pacific slope rank high among the foremost of American institutions devoted to this field. To James A. B. Scherer, under whose leadership as president the California Institute of Technology has played an important role in formulating and maintaining these high standards of technical education, this issue of the Journal of Electricity is affectionately dedicated.

Mr. Spry briefly outlined the Weber-Provo project, which, he said, contemplated the reclamation of 2,000,000 acres of land, or more than is now under irrigation in the area included in its boundaries. He said this would cost not more than \$7,000,000 or \$8,000,000. "Our need is to educate Congress to the necessity of reclaiming the public lands, either by irrigation or by drainage," he asserted.

Electrical Table at Portland Chamber of Commerce

The electrical industry of Oregon was well represented at an informal luncheon at the Portland Chamber of Commerce, Friday noon, July 9. Seated around the table were: F. N. Averill, Fobes Supply Company; J. R. Tomlinson, Pierce-Tomlinson Electric Company; W. C. Heston, Portland



The first luncheon held around the Electrical Table which is to be a weekly feature for electrical men at the Portland Chamber of Commerce.

Railway, Light and Power Company; P. J. Kean, Pacific Power & Light Company; C. M. Will, Fobes Supply Company; J. P. Mundt, secretary Oregon Association of Electrical Contractors and Dealers; F. H. Murphy, C. P. Osborne, Portland Railway, Light and Power Company; R. C. Kenny, NePage-McKenny Company; Geo. L. Meyers, Pacific Power & Light Company, and J. H. Sroufe, Jaggar-Sroufe Company.

It is planned to have these gatherings every Friday and everyone connected with the industry will be encouraged to get into the habit of taking their Friday lunch at the Electrical Table. No set programs are contemplated, the idea being to secure better acquaintance and closer harmony in the industry.

Contractor-Dealer Meetings in Salt Lake City

A special feature of the regular meeting and luncheon of the Electrical Contractors and Dealers' Association of Salt



Officers of the Electrical Contractors and Dealers' Association of Salt Lake City. Left to right: G. R. Randall, vice-president; L. G. Robbins, treasurer; G. W. Forsberg, president; T. H. Eardley, secretary.

Lake City, held a short time ago at the Commercial Club of that city, was a very interesting talk by A. T. Tregoning, of the San Francisco office of the McGraw-Hill Company.

Mr. Tregoning told what was being accomplished in the California Cooperative Campaign, and presented some very valuable ideas and suggestions for a similar movement in Salt Lake City.

At the regular meeting of the Association, held on Tuesday, July 6th, the present officers of the Association were re-elected for another year. The officers are as follows: G. W. Forsberg, president; G. R. Randall, vice-president; L. G. Robbins, treasurer, and E. H. Eardley, secretary.

A. I. E. E. CONVENTION AT PORTLAND

(Continued from page 116)

on the line as induction motors. Many synchronous motors are also used in mine service for haulage.

W. J. Davis pointed out that California companies could not make planned installations without synchronous condensers for voltage control on long lines. Mr. Carpenter of Washington drew attention to the fact that the arithmetic sum of energy and reactive components is a direct gauge of system losses; that is, 99 power factor and 14% reactive give losses of relation of 113 to 100 for unity power factor.

Golf

The results of the golf tournament on Friday, July 23, were as follows:

- 1st. (Winner of Fiskien cup and leather wallet) C. L. Wernicke, low net seventy.
- 2nd. (Winner of desk clock) E. F. Whitney, low gross seventy-three.

On the completion of the game the players joined the party starting on a trip over the Columbia Highway. The day concluded with a banquet at the Crown Point Chalet, with one hundred and sixty-five present. A feature of the evening was an address by W. H. Galvani of the Right of Way department of the Pacific Power & Light Company.

A large party left on Saturday for Seattle, continuing on number 15 Canadian Pacific Sunday.

The large attendance at this convention and the great enthusiasm shown in both the business and entertainment programs mark it as one long to be remembered by all those present.

REGISTRATION, PACIFIC COAST CONVENTION A. I. E. E. JULY 21-24, 1920

Apperson, A. L.	Portland, Ore.
Armstrong, G. E.	San Francisco, Cal.
Armstrong, R. M.	Portland, Ore.
Alger, P. E.	Portland, Ore.
Bankus, J.	Portland, Ore.
Barker, G. N.	Portland, Ore.
Barry, E. J.	Tacoma, Wash.
Bastian, H.	Portland, Ore.
Batcheller, W. T.	Seattle, Wash.
Bates, D. I.	Portland, Ore.
Bates, J. H. S.	Olympia, Wash.
Beebe, J. D.	Portland, Ore.
Beeuwkes, R.	Seattle, Wash.
Berui, A. F.	Portland, Ore.
Billica, H. J.	San Francisco, Cal.
Billica, Mrs. H. J.	San Francisco, Cal.
Blackburn, E.	Portland, Ore.
Boring, G. A.	Portland, Ore.
Boring, Mrs. G. A.	Portland, Ore.
Boring, H. A.	Seattle, Wash.
Boyer, W. H.	Portland, Ore.
Boykin, R. M.	Portland, Ore.
Campbell, W. W.	Hoquiam, Wash.
Carlson, E. L.	San Francisco, Cal.
Carpenter, H. V.	Pullman, Wash.
Cayo, A. B.	Portland, Ore.
Childs, R. B.	Seattle, Wash.
Clark, J. C.	Palo Alto, Cal.
Clark, Mrs. J. C.	Palo Alto, Cal.
Code, E. S.	Seattle, Wash.
Coe, C. H.	Tillamook, Ore.
Coldwell, O. B.	Portland, Ore.
Collins, E. S.	Portland, Ore.
Cone, D. I.	San Francisco, Cal.
Corbet, D.	Seattle, Wash.
Crawford, C. C.	Seattle, Wash.
Cunningham, E. R.	Portland, Ore.

Cushing, A. S.	London, England	Scott, J. D.	Portland, Ore.
Dater, D. H.	Portland, Ore.	Scott, W. A.	Portland, Ore.
Dashley, L. H.	Seattle, Wash.	Scott, W. D.	Seattle, Wash.
Davidson, R. J.	Portland, Ore.	Scott, Mrs. W. D.	Seattle, Wash.
Davis, W. J., Jr.	San Francisco, Cal.	Searing, E. D.	Portland, Ore.
Dearborn, R. H.	Corvallis, Ore.	Shaw, J. L.	Portland, Ore.
Dederick, C. R.	Portland, Ore.	Shepard, F. H.	New York, N. Y.
Dodds, J. M.	Seattle, Wash.	Shepard, W. M.	San Francisco, Cal.
Easter, R. R.	Hillsboro, Ore.	Shinn, J. E.	Astoria, Ore.
Elder, L. E.	Portland, Ore.	Siegfried, J. H.	Kennewick, Wash.
Evenson, F. F.	Clatskanie, Ore.	Skeen, R.	Portland, Ore.
Fake, F. C.	Portland, Ore.	Smith, W. C.	Palo Alto, Cal.
Fear, Lyle G.	Portland, Ore.	Sorensen, R. W.	Pasadena, Cal.
Ferrer, F.	Portland, Ore.	Stauffer, E. R.	Los Angeles, Cal.
Frogner, G. A.	Spokane, Wash.	Stafford, R. T.	Seattle, Wash.
Fisk, J. B.	Spokane, Wash.	Streiff, A.	Portland, Ore.
Frost, C. M.	Portland, Ore.	Sturges, I. B.	Portland, Ore.
Gifford, F. L.	Portland, Ore.	Swift, A. H.	Powell River, B. C.
Graf, S. H.	Corvallis, Ore.	Tappan, F. G.	Norman, Okla.
Gray, H. L.	Seattle, Wash.	Trabert, A. W.	Seattle, Wash.
Gowden, J. P.	Seattle, Wash.	Turner, W. S.	Portland, Ore.
Hampton, J.	Portland, Ore.	Volpe, J. S.	Portland, Ore.
Harris, G. F.	Portland, Ore.	Wallis, C. R.	Seattle, Wash.
Hartwig, L.	Portland, Ore.	Wakeman, H. R.	Portland, Ore.
Hawley, K. A.	New York, N. Y.	Walther, H. L.	Medford, Ore.
Hayward, R. F.	Vancouver, B. C.	Ward, S. G.	Portland, Ore.
Healey, E. S.	Portland, Ore.	Weber, F. D.	Portland, Ore.
Henny, D. C.	Portland, Ore.	Wells, J. G.	Seattle, Wash.
Hellenthal, J.	Seattle, Wash.	Wernicke, C. L.	Portland, Ore.
Henderson, D. F.	Spokane, Wash.	Whipple, C. A.	Seattle, Wash.
Henkle, J. C.	Portland, Ore.	Whitmore, Earl	Portland, Ore.
Heston, W. C.	Portland, Ore.	Whitney, E. F.	Portland, Ore.
Hillebrand, W. A.	San Francisco, Cal.	Williams, L. C.	Alameda, Cal.
Hindman, L. E.	Portland, Ore.	Woodbridge, J. E.	San Francisco, Cal.
Hippley, E.	Portland, Ore.	Wooster, L. F.	Corvallis, Ore.
Hizawa, G.	Tokyo, Japan	Wright, J. L.	Portland, Ore.
Horn, C. H.	Oswego, Ore.	Yates, J. E.	Portland, Ore.
Howell, H. D.	Denver, Colo.	Zimmerman, P.	Yamhill, Ore.
Husbands, R. H.	Seattle, Wash.		
Hutchinson, F. L.	New York, N. Y.		
Hynes, W. F.	Portland, Ore.		
Hippeley, E.	Portland, Ore.		
Jones, D. M.	Schenectady, N. Y.		
Kennedy, J. B.	Portland, Ore.		
Knowles, C. S.	Kennewick, Wash.		
Kramer, E. W.	Portland, Ore.		
Kurtichanof, L. E.	Portland, Ore.		
Kurtichanof, Mrs. L. E.	Portland, Ore.		
Lauridsen, L.	Portland, Ore.		
Lawson, F. I.	Minneapolis, Minn.		
Ledenbaum, P.	Portland, Ore.		
Lebanbaum, P.	Portland, Ore.		
Le Fever, O. L.	Portland, Ore.		
Lindsay, S. C.	Seattle, Wash.		
Lindsley, W. R.	Portland, Ore.		
Lund, C. A.	Tacoma, Wash.		
Lundell, C. H.	Portland, Ore.		
Luther, C. D.	Seattle, Wash.		
Magnusson, Dr. C. E.	Seattle, Wash.		
Mangold, A. O.	Portland, Ore.		
Manny, H. H.	Seattle, Wash.		
Martin, A., Jr.	Portland, Ore.		
Mastick, R. W.	San Francisco, Cal.		
Mastick, Mrs. R. W.	San Francisco, Cal.		
Mears, A. W.	Portland, Ore.		
Mears, H. J.	Portland, Ore.		
Meece, J. C.	Portland, Ore.		
McClung, D. R.	Portland, Ore.		
McMicken, A. C.	Portland, Ore.		
McMillan, F. O.	Corvallis, Ore.		
Merwin, L. T.	Portland, Ore.		
Miles, J. G.	Seattle, Wash.		
Miller, A. S.	Seattle, Wash.		
Miller, C. A.	Tacoma, Wash.		
Mini, J., Jr.	San Francisco, Cal.		
Mong, C. E.	Seattle, Wash.		
Moody, A. S.	Portland, Ore.		
Moody, Mrs. A. S.	Portland, Ore.		
Moyer, L. M.	Portland, Ore.		
Muirhead, J.	Vancouver, B. C.		
Murphy, M. F.	Seattle, Wash.		
Monges, R. F.	Portland, Ore.		
Murphy, F. H.	Portland, Ore.		
Neill, W. T.	Salem, Ore.		
Nicholas, R. W.	Portland, Ore.		
Nims, F. D.	Seattle, Wash.		
Nixon, G.	Spokane, Wash.		
Osborne, C. P.	Portland, Ore.		
Paine, E. A.	Portland, Ore.		
Pearson, E. F.	Portland, Ore.		
Peaslee, W. D.	Huntington, West Va.		
Pestell, W.	Chicago, Ill.		
Phillips, L. L.	Portland, Ore.		
Plumb, H. T.	Salt Lake City, Utah		
Polhemus, J. H.	Portland, Ore.		
Pratt, A. C.	Butte, Mont.		
Proebstel, D. W.	Portland, Ore.		
Prior, D. F.	Santa Rosa, Cal.		
Quinan, G. E.	Seattle, Wash.		
Ramsay, J. W.	Pullman, Wash.		
Rands, H. A.	Portland, Ore.		
Read, L.	Portland, Ore.		
Read, J. R.	Vancouver, B. C.		
Redman, F. W.	Portland, Ore.		
Reed, M. E.	Portland, Ore.		
Riggs, A. C.	Seattle, Wash.		
Robley, R. R.	Portland, Ore.		
Rockwood, J. A.	Portland, Ore.		
Rowe, G. H.	Boise, Idaho		
Ryan, H. J.	Palo Alto, Cal.		
Ross, L. W.	Portland, Ore.		
Sampson, C. N.	Portland, Ore.		
Schoolfield, H. H.	Portland, Ore.		

Investment Bankers' Association

At a recent meeting of the Board of Governors of the Investment Bankers' Association of America the following resolution was passed:

"Whereas, Investment bankers are expected to purchase and distribute the securities of public utility companies which must be sold if utilities are adequately to supply the demands upon them for local transportation, light, heat, power and the transmission of messages, and

"Whereas, The credit of many of the public utility companies will not permit the sale and distribution of such securities, thus interfering with the development of many commercial enterprises, the welfare of many communities and the comfort and convenience of a great many people, and

"Whereas, The credit of the public utilities is largely dependent upon the attitude of the public as expressed through the various governing and regulatory bodies,

"It is hereby Resolved, by the Board of Governors of the Investment Bankers' Association of America, that as steps in the restoration of the credit of the public utilities:

"1. Term franchises should be superseded by indeterminate permits securing the right to operate under proper regulation during good behavior with provisions for equitable adjustment of rates from time to time, as tending to eliminate controversies which inevitably impair the public service, the credit of the companies involved and the value of their securities.

"2. The power of regulation and control of public utilities should be vested in state commissions as tending towards standardization of regulation which is not possible under local regulation.

"3. Members of state commissions should be appointed. "If commissioners are elected they are frequently embarrassed by political policies and platforms in the consideration of questions which should be decided only on sound economic and financial principles."

San Francisco Electrical Development League

Because of the numerous vacations which are now under way among men of the electrical industry, the regular weekly meetings of the San Francisco Electrical Development League have been suspended until September.

San Francisco Section, A. I. E. E.

The regular weekly luncheon of the San Francisco Section of the American Institute of Engineers held at the Engineers' Club on July 28th was especially well attended, because of the fact that F. L. Hutchinson, secretary of the Institute, was the guest. Mr. Hutchinson gave a talk on the aims and ideals of the Institute. This visit to San Francisco is a part of the tour he is making in visiting the various A. I. E. E. sections.

COMING CONVENTIONS

American Society of Civil Engineers—

Portland, Oregon, August 10-11

Northwest Electric Light and Power Association—

Spokane, Washington, September 8-11

HAPPENINGS IN THE INDUSTRY

POWER RESTRICTIONS LIFTED IN SOUTHERN CALIFORNIA

H. G. Butler, power administrator of the Railroad Commission of California, has stated that all restrictions on power for companies operating south of Merced will be lifted by the first of September. Mr. Butler stated:

"The restrictions placed on the power companies early this spring, together with cold weather in April, May and June and late rains, increased the available water supply and kept the load light. This, with the new 17,000-hp. power plant of the city of Los Angeles placed in operation a week ago and the three plants which will be in operation within 30 days, one of 8,000 hp. of the city of Los Angeles and two of the San Joaquin Light & Power Corporation, totaling 70,000 hp., have relieved the situation to such an extent that the danger of shortage for this year has passed. It will be necessary, however, to operate all steam plants to practically full capacity during this season. Accidents in the power plants might make restrictions necessary, but they would only be temporary. With normal rainfall this winter there should be sufficient power next year for southern California. In addition to the new plants which have been mentioned, there will be available for next summer, plants now under construction as follows: Southern California Edison Company, 40,000 hp.; Los Angeles Gas & Electric Corporation, 10,000 hp.; San Joaquin Light & Power Corporation, 17,000 hp.; City of Los Angeles Power Bureau, 10,000 hp., and Southern Sierras Power Company, 3400 hp., a total of 80,400 hp."

Mr. Butler also stated that existing restrictions governing the use of power furnished by the companies operating north of Merced had not been removed, but that conditions have recently required that the existing restriction on the companies north of Merced be made more rigid and that there is no prospect of their being removed until the fall rains replenish the streams which supply the hydroelectric plants.

THE FEDERATED AMERICAN ENGINEERING SOCIETIES

One of the outstanding features of the Organizing Conference held in Washington during June was the enthusiastic interest and cooperation exhibited by the delegates of the local, state and regional engineering organizations. It is not surprising therefore that these organizations should be among the first to apply for membership in the Federated Engineering Societies. In this connection it is interesting to note that the Technical Club of Dallas, at its meeting of June 22, made application for membership and at the same time filed its claim to being the first local organization to apply.

The report of the delegates to the Washington Organizing Conference was read at the meeting of the Board of Directors of the American Institute of Electrical Engineers at the annual convention at White Sulphur Springs, West Virginia, June 30, and the following resolution was adopted:

"Resolved, That it is the sense of this Board that the A. I. E. E. should join the Federated American Engineering Societies, but that as there is a small attendance at this meeting and a new Board will be constituted commencing with the administrative year on August 1, action be deferred until the August meeting of the Board and that a letter be sent to the members of the incoming Board, with a request that they give careful consideration to the matter and be prepared to act at the next meeting."

The report of the delegates to the Washington Conference was read at the meeting of the Board of Direction of the American Institute of Mining and Metallurgical Engineers on June 25, was favorably discussed and referred to the

Finance Committee to devise and report on means of meeting the financial requirements.

The report of the delegates to the Washington Conference representing the American Society of Civil Engineers will be presented at the annual convention of the society, at Portland, Oregon, August 10-12, 1920.

The organization is to deal with what are commonly known as welfare or non-technical matters. It is not a social organization; it is not an organization of individual members. As its title indicates, it is a federation of societies with whose autonomy and activities it in no way interferes. It does not create a new technical society but it will succeed the present Engineering Council and will be more comprehensive as to scope and membership.

WORK ON CARIBOU PLANT

Work is being rushed on the tunnel to connect Big Meadows with Butt Valley, where the Great Western Power Company is constructing its \$8,000,000 Caribou hydroelectric plant. Some of the canals and ditches at the upper end of the transmission system have been completed. Most of the remaining work remains at the Caribou end of the project.

CALIFORNIA-OREGON POWER COMPANY APPLIES FOR RATE READJUSTMENT

The California-Oregon Power Company has asked for final readjustment of its rate on the grounds that it is now in a position to determine the effect upon its revenue of the rates fixed by the Railroad Commission on a previous application. In its former decision the Commission ordered the company to withdraw meters with the result that today more than 90 per cent of its consumers are being so served, a fact set up by the company in its request for the final readjustment of rates. It is further claimed by the company that it has in prospect the organization of its financial structure with a view to enabling it more readily to obtain the necessary funds for the construction of new power plants or increasing the capacity of existing plants and making extensions and enlargements of its system for the logical and proper development of its territory.

ENTERPRISE ELECTRIC COMPANY PLANS NEW PLANT

The Enterprise Electric Company, operating in the northeastern part of the state of Oregon, which supplies power and light to the towns of Enterprise, Evans, Joseph, Lostine, and Wallowa, will begin construction at once of a hydro-electric plant diverting the waters of the Wallowa river above the lake. The first unit to be installed will consist of a Henry impulse turbine operating under a head of 800 feet, which will drive an 800-kilowatt, 6600-volt, 60-cycle, 3-phase generator. The company at present has a generating capacity of 400 hp. and has three plants at Joseph, Enterprise and Wallowa.



The above picture was taken at the annual meeting of the California Association of Electrical Contractors and Dealers which was held in San Jose a short time ago. A full report of this convention appeared in the last issue of the Journal of Electricity.



EDISON MEN VISIT KERN RIVER

Over seventy of the district managers and department heads of Southern California Edison Company composed a party which visited the new plant, Kern River Number Three, during the last week in June. The object of the excursion was to explain the details of the project to the commercial men whose duties as a rule prevent their acquiring an intimate knowledge of the company's work in the mountains. The party was taken over the entire project, the excursion concluding with a business meeting and entertainment program at the construction camp.

PACIFIC GAS & ELECTRIC COMPANY TO BUILD HIGH HEAD PLANT

The Pacific Gas & Electric Company is preparing plans for a power house to be located on the Stanislaus river on property acquired by lease from the Sierra & San Francisco Power Company. This power house will have a head of 2400 ft. which will make it one of the highest head plants in the United States. The plant will have a capacity of 7500 kw. and work will be started on it at once so that it will be completed by this winter. Some other work is being done on the property of the Sierra & San Francisco Power Company, part of this being a third penstock which is being installed on the Stanislaus plant to increase its efficiency.

CALIFORNIA STATE WATER COMMISSION MAKES HYDRO-GRAPHIC SURVEY

The engineering department of the State Water Commission has commenced a hydro-graphic survey of Hat Creek in eastern Shasta county. Mr. Gordon Vander, engineer for the Commission, is in charge of the work, and measurements are being made of the capacities of all irrigation ditches and the quantity of water diverted from the stream by the various water users. This survey is being made in connection with the case of Doyel vs. Massie, et al., which involves seventy-three claimants of water rights from the creek. The case originally involved as plaintiff and defendant only a small proportion of the water users on Hat Creek, but in order to determine all water rights on the stream at once and so forestall future litigation, all the water users on the stream were brought into the case, which has been referred to the Water Commission to make findings.

ANNUAL STOCKHOLDERS' MEETING

At the annual meeting of the stockholders of the Idaho Power Company, held in May, the following directors were elected:

George A. Bremer, J. W. Cunningham, E. H. Dewey, R. B. King, C. E. Groesbeck, F. F. Johnson, W. P. Lyon, O. G. F. Markus, D. F. McGee, E. J. Ostrander, W. R. Putnam, D. W. Standrod, E. R. Tinker, E. A. Van Sicklin, William T. Wallace, H. J. Ward.

At the first meeting of the board since the annual stockholders' meeting, the officers of the company were elected for the ensuing year:

President, F. F. Johnson; chairman board of directors, F. F. Johnson; vice-president, William T. Wallace; vice-president and general manager, W. R. Putnam; vice-president, E. W. Hill; vice-president, D. F. McGee; general superintendent, R. B. King; chief engineer, W. H. Trenner; secretary, C. T. Ward; treasurer, A. E. Janssen; assistant secretary, E. P. Summerson; assistant secretary, H. L. Martin; assistant secretary, A. E. Janssen; assistant treasurer, William Reiser; assistant treasurer, A. C. Ray; assistant treasurer, R. W. Miller; assistant treasurer, G. J. Hickman; clerk, Ernest L. McLean.

EXTENSIVE LIGHTING SYSTEM FOR LONG BEACH

At an informal conference of the City Commissioners of Long Beach plans were discussed for making a uniform system of ornamental street lighting throughout the business district of the city. Under a proposed ordinance electroliers will shortly be erected on Fourth Street between Pine and

Alamitos streets, the plans calling for a steel standard costing approximately \$100.00. At the present time there are several different styles of standards in service in Long Beach and it is the desire of the commissioners and city engineers at this time to take steps towards having a uniform system. City Attorney Hoodenpyl favors the cement standard on the ground that metal posts rust in the moist air of the beach.

STEAM HEATING RATES

The Northwestern Electric Co. of Portland, through an application filed with the Oregon Commission July 2, asks for an increase in steam heating rates. The hearing will probably be set for some time in August. The company states in its application that the revenue from its steam heating department is not sufficient to cover the cost of operation.

ELECTRIC POWER CONSUMPTION, C. M. & ST. P. RAILWAY

(Continued from page 118)

Costs of Maintenance and Operation

The cost of maintaining and operating the transmission lines, substations, and trolley system, for the year 1919 is given below and a final figure thus arrived at showing the approximate total operating costs involved in the delivery of the electric energy to the locomotives.

Account	Total	All Services	Per Unit
255. Power Substation Buildings	\$ 8,487	\$ 606.00	per Bldg.
257. Power Transmission System	1,773	4.87	" mi.
259. Power Distribution System	78,461	179.00	" route mi.
261. Power Line Poles and Fixtures	24,299	55.50	" " "
306. Power Substation Apparatus	40,224	2870.00	" station
383.		7300.00	" "
395. Train and Yard Power Produced	102,152		
Total,		\$255,396	

The installation being comparatively new it might naturally be assumed without consideration of other facts that the figures for the maintenance are considerably lower than those which will eventually obtain, but it should also be borne in mind that the maintenance and operating costs given will, except for power, remain more or less constant as far as any consideration of their being affected by the business handled is concerned, so that the cost per thousand ton miles would be correspondingly reduced as business is increased. It is also expected that considerable improvement will be effected in maintenance methods which would again tend to reduce costs. The figures are therefore given merely to show the results which are at present being obtained.

SEMI-ANNUAL SALES CONFERENCE

The San Francisco district of the Western Electric Company held its semi-annual sales conference July 15 and 16. The meeting proved to be one of the most interesting and successful events of the year in the electrical industry on the Pacific Coast.

An interesting feature of this Conference was an invitation extended by the Western Electric Company to its contractor and supply-dealer customers to attend the meetings and listen to the sales talks by manufacturers. That this invitation was appreciated is evidenced by the large attendance and keen interest shown.

The banquet and entertainment Friday evening, over which W. S. Berry, district manager of the Western Electric Company, presided, proved a fitting climax to the business sessions.

AUTHORITY TO ISSUE NOTES

The San Joaquin Light & Power Corporation has been authorized by the Railroad Commission to issue notes in the aggregate face value of \$388,163.31 to pay or refund notes now outstanding. The original notes were issued in connection with the financing of construction work on the company's plant at Bakersfield and for hydroelectric development.

The Commission has also authorized the San Joaquin company to endorse notes to be issued by the Midland Counties Public Service Corporation, the payment of which will be secured by the deposit of \$605,000 of bonds, authority to issue which has been granted by the Commission.

Western States Gas and Electric Company has been authorized by the Railroad Commission to issue \$300,000 face value of its $6\frac{1}{2}\%$ collateral trust notes, due August 1, 1923, and to issue and deposit as security for the payment of these and other notes issued under authority of the Commission \$439,000 of bonds, also authorized by the Commission. A supplemental order by the Commission provides for the disposition of the proceeds of the sale of \$198,000 of bonds.

THE ELECTRIC FURNACE LOAD

A letter to the Editor

The Journal of April 15th, page 358, reviews an article by Mr. W. M. Shepherd, who gives some very good information as to the extent and possibility of the electric load for Californian central stations. We are very glad to see the assurance given by such an authority as Mr. Shepherd that the electric furnace load is desirable, and one that does not need particular nursing by the central stations. There are still very substantial shipments of steel castings from the East, but in our opinion it is only a matter of time before the castings manufacturers in the West realize that a properly constructed and designed electric furnace will give them equally high quality of castings to those made in the East.

In connection with this, we would suggest that the intending furnace user should not place too much prominence upon the remarks of Mr. Shepherd as to the use of an acid lined furnace rather than a basic lined. For melting up scrap of good quality rapidly, there is no doubt that the acid furnace has much to commend it, but the steel maker should not lose sight of the fact that the electric furnace is primarily a refining and purifying instrument. It is not the cheapest melting down instrument. Refining is impossible in the acid lined furnace, and thus one of the chief advantages of the electric furnace is lost by an acid lined furnace.

It is not the purpose of this letter to advocate basic lined furnaces, but merely to point out that a basic furnace will run just as fast as an acid furnace—it is merely a question of the number of heat units put into the furnace—and in addition the basic furnace user is bound to refine his charges, even if he does not go to the length of changing slags, as when making high grade steels.

Many of the better steel makers out in California are running their furnaces basic, and if the steel casting maker in California wishes to compete in quality as well as quantity with the Eastern manufacturer the basic lined furnace will be found generally to be more satisfactory.

The acid lined furnace is often the refuge of the man who wishes to convert 100% scrap into 50% castings and get 100% prices. Unquestionably, the better steel can be made in basic lined furnaces, and it is along this line that real development of California's steel casting making will come.

Yours very truly,

FRANK HODSON, President,
Electric Furnace Construction Co.

ELECTRIC WELDING OF COPPER

A letter to the Editor.

(A letter of inquiry recently reached this office regarding a copper welded ring referred to in an article by F. A. Anderson in the Journal of Electricity, December 1, 1919, and January 1, 1920. As the author's reply may be of interest to others, a part of it is reproduced here.—The Editor.)

The Journal of Electricity:

This ring was not welded by the Slavianoff process, but was an arc welding operation.

By referring to the article mentioned you will see that the Slavianoff process uses the welding rod as an electrode, and that the Bernardos process uses one carbon as an electrode, while the welding rod of the desired metal is fed into the arc. There have arisen so many variations that these names are rarely used today and the term "arc welding" includes all of the original processes together with the numerous variations which have been developed to meet conditions.

Again referring to the ring, this is one of several which were cut from an edgewise wound copper coil, the ring was then placed on a graphite plate; at the open ends a small piece of the same copper is laid, then by the use of a half inch carbon electrode a short arc was struck on the extra piece of copper. As soon as fusion was started the carbon electrode was placed against the metal, closing the arc and using the heat generated by the contact resistance to hold the metal in a molten or fluid state until a uniform thickness and union of the metals had been obtained. While the metal was still red hot, it was immersed in water. It was then reheated and cooled two or three times, this process changing the character of the metal in the weld from that similar to a cast state into that more nearly resembling the wrought state. After this the ring was finished by filing and using fine emery, since which time it has been almost impossible to detect the place where the weld was made.

The machine used was a variable voltage arc welding set in which it was possible to get a very low voltage and to adjust the amperes to the desired value.

Such an arrangement as is used in welding this copper may not be possible in general practice, but it is almost always possible to find a way of accomplishing the desired result. It would, however, be hard to give advice that would apply generally, for the conditions existing would have to be studied and a plan devised for meeting them.

It has been common practice for a number of years to weld copper by the resistance method and where it is convenient to apply this method its application becomes simpler and more satisfactory.

FILING PAMPHLETS

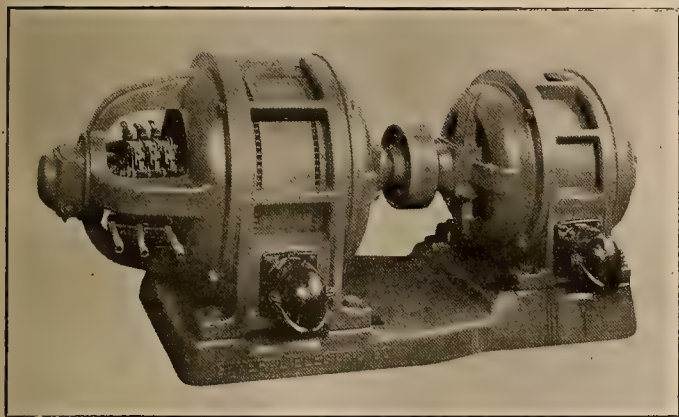
The filing of pamphlets and clippings is inadequately done in most business libraries. A series of articles by Miss Virginia Fairfax, librarian with the Carnation Milk Products Company, which is to be started soon in the Journal of Electricity, will take up this subject in detail. Watch for it.

LATEST IN EVERYTHING ELECTRICAL

(The device shown on this page is of particular interest because it makes it possible to apply high speed induction motors to various types of machines, thus eliminating belts or gears. An ingenious arrangement of a double-duty socket is also shown. Among the Books and Bulletins appear brief reviews of an Electrical Trades Directory from England and of technical university publications.—The Editor.)

NEW APPLICATION OF HIGH SPEED INDUCTION MOTOR

A new application of the high speed induction motor to certain classes of machine drive, especially in the wood working and metal trades industries, has been made possible by the development of an induction frequency changer by the General Electric Company. This device generates power at frequencies which will produce speeds of 18,000 r.p.m. or higher, and, as a result high speed induction motors can be



Induction frequency changer IH 332-60/270-25 kw., 1800 B-220/155 direct connected to induction motor KT-323-4-30-1800 B-220.

directly applied to various types of machines, eliminating belts, or gears with their disadvantages.

The frequency changer is a simple enough device, consisting of a slip ring, or wound rotor type of induction motor, which may be driven either by a belt, or directly, the stator being connected electrically to an a.c. source of power. By rotating the machine in a direction opposite to that in which it would run as a motor, frequencies are generated in the rotor equal to that of the exciting circuit plus that due to the reversed rotation of the rotor.

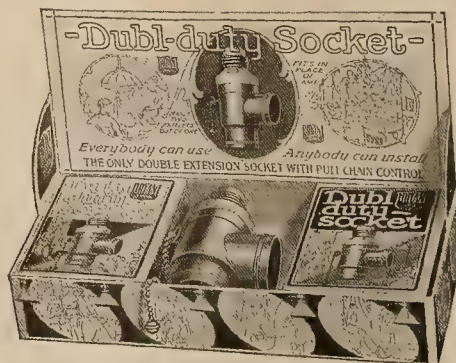
Practically all the energy taken from the commercial circuit is transformed into high frequency energy to drive the machine motors, the overall efficiency being approximately 90%. Where d.c. power is all that is available an inverted rotary converter can be used both as a motor to drive the frequency changer and supply the excitation for the stator. The high frequency supplied by this device being always three-phase secures uniformity as well as economy and simplifies both the motors and the frequency changers. The most economical sets are those having driving motors direct connected to the frequency changers.

Successful applications of these motors have been made to such wood working machines as shapers, saws, tenoners, and drills, all applications being direct with speeds ranging from 7200 r.p.m. to 12,000 r.p.m.

DOUBLE-DUTY SOCKET DISPLAY

The demand for a two-outlet socket has increased so that the Bryant Electric Company of Bridgeport, Connecticut, have decided to handle the production and packing of same as a separate, complete article rather than as a part of their "New Wrinkle" line.

Each socket is now being packed in a three-color carton, which not only facilitates handling but serves to enhance shelf and counter display. In addition an unique counter or window display box is provided for the use of dealers. This is printed in three colors to harmonize with the individual containers. One of these display boxes, with two dummy containers and a special cradle, is included with each standard



The effective display which can be arranged by placing a double duty socket between the two individual containers.

package of twenty sockets. An effective display can readily be arranged with this outfit—using an actual socket resting in this special cradle between two individual containers as shown in the illustration.

BOOKS AND BULLETINS

Electrical Trades Directory

The Electrical Trades Directory and Handbook or Blue Book, as it is popularly known, is the recognized work of reference for the electrical engineering and allied trades in England. Benn Brothers, Ltd., publishers of this directory, announce that the 1920 edition marks its 38th consecutive issue and that this year it has been re-set from cover to cover.

The handbook section deals with power distribution and transmission, with traction, submarine cables and land lines of the world and with wireless telegraphy and telephony. The legal digest has been compiled by a well-known authority on the law as it relates to electricity supply. The alphabetical section contains the name and address of practically everyone associated with British electrical engineering and allied industries, of municipal authorities and supply companies, with important details of the supply systems and the names of chief officials.

University Publications

The Engineering Experiment Station of the University of Washington has published a bulletin under the title, "Electrometallurgical and Electrochemical Industry in the State of Washington," by Charles Denham Grier.

This paper makes a general survey of the requirements of electro-metallurgical industries in the state of Washington, in such a way as to give the non-technical reader a better understanding of the matter. The chapters on Potential Water Power are especially interesting.

NEW ELECTRICAL DEVELOPMENT

(The Northwest reports plans for the extension of power lines and for the construction of a hydroelectric plant on the Wallowa River. Items of interest from the Pacific Central District include the rebuilding of a high-voltage line, plans for the construction of electrically-driven vessels and the announcement that power shortage has been removed. Extensive improvements on electric railway lines are being planned in the Southwest while the Intermountain District reports important meetings, progress in street lighting and plans for the construction of a new power plant.—The Editor.)

THE PACIFIC NORTHWEST

HELENA, MONT.—The Commercial Club is taking up with the city authorities the question of establishing a lighting and parking district the full length of Helena Avenue.

YAKIMA, WASH.—Pacific Power & Light Company, in this place, has plans under way for construction of a \$10,000 boiler house, which is desired to provide room for another gas bench.

BEND, ORE.—Charles A. Brown, president of the Bend Water, Light & Power Company, announces that power development of Tumalo Creek will be definitely started this summer. The cost of two plants contemplated is \$250,000.

NANAIMO, B. C.—Laying a mile pipe line from a 200-acre reservoir in the mountain district to Milstone is an extension to its system that is to be constructed by the Nanaimo Electric Light Company. The new power house will be constructed at the end of the line.

BELLINGHAM, WASH.—Application has been made by the Puget Sound Power & Light Company for a fifty-year franchise to extend power lines over a total of 30 roads in Whatcom county and to many parts of the county not now supplied with light and power. A hearing will be had on August 9.

PORTLAND, ORE.—The American Can Company has made application for a building permit to construct a three-story factory in the Guilds Lake district, to cost when completed between \$1,000,000 and \$1,500,000. The plant will be electrically operated throughout and will have an installed motor capacity of about 500 hp., consisting principally of 220-volt induction motors.

SPOKANE, WASH.—The Nixon-Kimmel Electrical Company of Spokane has put out a special unit consisting of dynamo, meter, switchboard and all necessary equipment for a farm lighting system, which is reported to be meeting with good demand. According to Mr. Nixon, the advantage of the unit is that it admits of the engine being used not only for generating lighting current but for other purposes at the same time.

TACOMA, WASH.—The State Public Service Commission has handed down a decision that the local street car company may for six months charge a ten-cent fare. The decision provides for the sale of commutation tickets at 8 cents each. The higher rate will be put into effect at once. The company has been charging a seven-cent fare. The commission specifies that when the company is relieved of certain franchise obligations commutation tickets shall be sold for 6-2-3 cents each.

PORTLAND, ORE.—The Enterprise Electric Company, operating in the northeastern part of the state of Oregon, will begin construction immediately of a hydroelectric plant diverting the waters of the Wallowa River above the lake. The first unit to be installed will consist of a Henry impulse turbine operating under a head of about 800 feet, which will drive an 800-kw., 514-r.p.m., 6600-volt, 60-cycle, 3-phase generator. The company at present has a generating capacity of 400 hp. in its three plants at Joseph, Enterprise and Wallowa.

SEATTLE, WASH.—NePage-McKenny Company, electrical engineers, contractors and manufacturers, Armour building, Seattle, have secured the contract for installation of complete

electrical equipment in the proposed two-story and basement office building to be erected for the Poulson Logging Company at Hoquiam, Washington, by J. L. Putnam, Securities Building, Seattle. Bebb & Gould, Securities Building, Seattle, are the architects on this job. The company also has the contract for installation of complete electrical equipment in the armory building to be erected in Everett, Washington.

THE PACIFIC CENTRAL DISTRICT

SANTA CRUZ, CAL.—The water system will be improved, \$15,000 having been set aside for the extension of pipe lines and other work.

MILL VALLEY, CAL.—An election will be held July 31st to vote on the formation of a lighting district to be known as Tamalpais Valley Public Highway Lighting District.

CORNING, CAL.—Fire started by lightning destroyed the Pacific Gas & Electric Company's substation here and as a result the town was without light and water for 24 hours. The damage was placed at about \$10,000.

SAN FRANCISCO, CAL.—A recent order by the Railroad Commission authorizes the Southern California Edison Company to subject to its mortgages the property and franchises recently acquired by the purchase of the Mt. Whitney Power and Electric Company system.

HILO, T. H.—The Hilo Electric Light Company, by reason of steady decline in its water supply, has been compelled to resort to a reserve steam engine to provide light and power. It is the opinion of some citizens that the supervisors should be induced to erect a pumping station.

SAN FRANCISCO, CAL.—The Sacramento Short Line is building a new substation at Concord, for the accommodation of the new fast electric car service now being scheduled. Hydro-electric power will be supplied by the Western Power Company. Assistant Supt. Neill is directing the new installation.

GREENVILLE, CAL.—Work on the tunnel leading from Lake Almanor to the new Caribou power plant in Butte Valley of the Great Western Power Company is progressing rapidly. The men have been paid large bonuses to rush the work. Some of the contracts on the upper end of the project are complete. Superintendent E. W. Beardsley and Consulting Engineer J. M. Howells are looking over the work.

YUBA CITY, CAL.—A meeting of all power users in Sutter county was called here on July 28th by Farm Adviser C. E. Sullivan at the instance of the State Power Commission. Officials of the Pacific Gas & Electric Company were present to explain to power users why restrictions have been placed this season, the restrictions seriously hampering many growers as well as crippling dredging, mining and other industries which require large voltages.

SACRAMENTO, CAL.—Late rains and low temperatures have removed the danger of a 20 per cent power shortage this summer, which had been threatened earlier in the season. State Power Administrator H. G. Butler said in an address here at a banquet to the Pacific Coast Rice Growers' Association. The shortage will not be serious except in case of accident, he said, provided the rice growers and other users continued to conserve electric energy.

SAN FRANCISCO, CAL.—The \$10,000,000 Pacific Gas & Electric Company five-year 7 per cent convertible gold notes, recently underwritten by Blythe, Witter & Co. and associates, have been entirely sold out and the syndicate is closed.

PLEASANTON, CAL.—Carl A. Reitz, inventor of small electrical motors, is here looking for a factory site. He states that he has an order from a barber supply concern in San Francisco for \$36,000 worth of motors to be attached to hair clippers.

NEVADA CITY, CAL.—The high voltage line of the Pacific Gas & Electric Company between the Colgate and Drum power houses is to be rebuilt during the next few months in order that the carrying capacity may be increased from 30,000 to 60,000 voltage. Materials are now being assembled and crews organized for the work. The line is thirty miles in length, and the rebuilding is estimated to cost \$225,000. The work will not be completed before January 2.

SAN FRANCISCO, CAL.—The Middle Yuba Hydro-Electric Power Company, which sells electric energy in the vicinity of Allegheny and Forest, Sierra county, has applied to the Railroad Commission for authority to increase its rates 15 per cent. The company buys its power from the Pacific Gas & Electric Company which was recently granted a raise of 15 per cent and it is to meet this additional cost of power that the Yuba company would advance its charges.

SAN FRANCISCO, CAL.—A. F. Haines, vice-president and general manager of the Pacific Steamship Company, has announced that plans for the construction of two electrically-driven vessels with a speed of twenty-three knots have been submitted for bids to Eastern and Pacific Coast shipbuilders. They will cost in the neighborhood of \$4,000,000 each and will have a carrying capacity of 590 passengers each. They will be placed in the Pacific Coast service between San Francisco, Los Angeles, San Diego, Seattle and Victoria.

SAN FRANCISCO, CAL.—Application for authority to increase its rates for electricity and gas sold in its Stockton division has been filed with the Railroad Commission by the Western States Gas & Electric Company. The Western company, which buys considerable energy from the Pacific Gas & Electric Company and the Great Western Power Company, claims that recent surcharges granted these companies by the Commission will add \$48,000 a year to its bills for purchased power, and that wage increases will add about \$36,000 a year to its pay roll.

SAN FRANCISCO, CAL.—Because the net income of the Ojai Power Company, which purchases its electric energy from the Southern California Edison Company, was practically wiped out by the increase in rates recently allowed the Edison Company by the Railroad Commission the Commission has granted the Ojai company authority to add a surcharge of 20 per cent to its power bills. The rate for lighting now being collected by the Ojai company is not disturbed by this ruling. The Ojai company operates in the Ojai Valley, Ventura county. The major portion of its business is supplying electricity for pumping purposes. The surcharge is to continue for twelve months, having been made temporary because the surcharge allowed the Edison company is of an emergency nature.

THE PACIFIC SOUTHWEST

LOS ANGELES, CAL.—The Baker Electric Company has leased the ground floor and basement of the two-story brick building, 445-453 S. Los Angeles Street.

TOMBSTONE, ARIZ.—Notice has been given that a special election will be held August 10th in the irrigation district now being formed and designated as San Pedro Water Users' Association, to determine whether the proposed district shall be organized.

ONTARIO, CAL.—Officials of the Pacific Electric Railroad announce that it is planned to extend the road from Corona-Riverside line to the Los Angeles-Sterns line, by building a road through Santa Ana canyon. This would give a direct line into Riverside via La Habra and Corona.

MEXICALI, MEX.—Thirty-one bids were received in Mexicali for a municipal water system to cost \$500,000. Thirty represented American concerns located in many parts of the United States. Because of the many bids of varied nature it will be several days before the contract is awarded.

LONG BEACH, CAL.—Practically all work on the city's new water well number 1 has been finished and as soon as the cement work is sufficiently dry water will be started through. Work on number 2 well will start immediately, to be completed within 30 days. More wells will be sunk as necessity demands.

TUCSON, ARIZ.—At a special meeting of the city council a permanent solution of the problem of purifying the water supply was offered when Councilman Mansfield proposed purchase of a chlorinating plant for use in connection with the pumping plant. The purchase of this plant met with favor by the mayor and other councilmen.

LOS ANGELES, CAL.—Extensive improvements involving the expenditure of \$150,000 have been announced by the Los Angeles Railway Company. The Western Avenue line will be extended from the present terminus to Santa Monica Boulevard. This improvement will cost \$50,000 and will be started as soon as necessary equipment is delivered. A new substation equipment will be installed to facilitate the receiving of power.

SANTA FE, N. MEX.—Sealed bids are being received by the board of trustees of the village of Deming, Luna county, New Mexico, up to 6 o'clock p.m. Aug. 2, 1920, for the sale of bonds of said village in the amount of \$100,000 for the purchase of the construction of a system for supplying water to the village. Said bonds will bear date of August 1, 1920 and will be issued in denominations of \$100, bearing 6 per cent interest payable semi-annually. Bids must be accompanied by a certified check of \$2,500.

LOS ANGELES, CAL.—A conference has been held at Hotel Lankershim with Arthur P. Davis, Director of the United States Reclamation Service, for the discussion of the prospective gigantic engineering feat of harvesting the melting season floods of the Colorado River for irrigation of millions of acres adjacent to the desert and dry land, with the chief reservoir on the Boulder Canyon site near the junction of the boundaries of Arizona, Nevada and California, Imperial Valley being one of the chief beneficiaries. The reservoir will cost more than \$50,000,000.

THE INTER-MOUNTAIN DISTRICT

BURLEY, IDA.—A special train arrived here last week bringing the members of the congressional committee on appropriations and other federal and state officials to visit some of the more notable sights of the Minidoka project.

BOISE, IDAHO.—The reclamation service will open bids at Boise August 24th for building sixteen miles of main canal on the Boise project. The work involves the excavation of 1,229,000 yards of material, and will be done near Caldwell, Idaho.

SALT LAKE CITY, UTAH.—Applications for more than 1,000,000 horsepower have been filed with the water power commission since the new water power bill became effective, according to Ralph R. Woolley, engineer of the United States Geological Survey.

BRIGHAM CITY, UTAH.—At a recent meeting of the city council, plans were discussed and details got under way for the calling of a special election to vote on the issuing of bonds in the approximate sum of \$120,000 for the rebuilding of the municipal electric light plant.

PARK CITY, UTAH.—The mines in the Alta and Cottonwood districts, practically all of which use electric power in their operations, are showing considerable activity recently, and several of them are resuming operations after being closed down, as far as shipments are concerned, for several months.

RIGBY, IDA.—The Rigby Electric Supply Co. of this city, and the Rexburg Electric Supply Co. of Rexburg, have consolidated their businesses and have opened their new place of business in Idaho Falls under the name of the Farm and City Electric Company. This makes one of the best equipped electric supply houses in Idaho Falls.

MT. PLEASANT, UTAH.—An increase in lighting rates has been proposed by the mayor and city council. The proposed increase is as follows: From 7c. to 9c. per kw-hr. for lights; from 2c. to 3c. for domestic power; from 2c. to 5c. for commercial power. The above increase is subject to approval by the public utilities commission of Utah.

MCCAMMON, IDA.—For the purpose of installing brighter street lights as several street intersections, the Utah Power & Light Company, at the request of the city council of this city, is testing out a number of 1000-candlepower lights, which will probably be accepted by the city, and placed in service within a short time. This will result in much-needed improvement.

ST. GEORGE, UTAH.—Sixteen pumps, with a total of 315 horsepower, are now being driven by electricity furnished by the Dixie Power Company in Parowan valley without lowering the level of the underground water. The community of Enterprise and vicinity will soon have a number of wells driven by electricity. It is believed the water strata in that locality is practically inexhaustible, and if such proves to be the case great development, including large sugar beet acreage, to keep the large sugar factories going, will undoubtedly take place.

SALT LAKE CITY, UTAH.—One of the most successful conferences of division managers and department heads was held by the Utah Power & Light Company at its general offices in Salt Lake City on July 15 and 16. D. F. McGee, of the Electric Bond & Share Company, and Lafayette Hanchett, who was recently elected president of the Utah Power & Light Company, attended the conferences. Some very interesting and instructive discussions took place. These conferences of division managers and department heads are held every two or three months, and the discussions and exchange of ideas are of considerable value to all concerned.

BOISE, IDA.—In the case of the Utah Power & Light Company the public utilities commission of Idaho has decided that regulations now in force must stand until more complete information concerning the valuation of the company's property is at the disposal of the commission. A complete survey of the company's property is necessary in determining just and reasonable rules for the extension of their service in the state of Utah, and such survey for the purpose of obtaining a valuation is now in progress. The power company's extension rule is the particular regulation which has been under consideration.

BONNERS FERRY, IDA.—C. D. Aspinwall, representative of the Westinghouse Electric & Manufacturing Company, was in the city re-

cently looking over the power site on the Moyie. He has since sent in a detailed estimate of the cost of machinery, wire and equipment necessary to install the plant and running power line to the city limits. His estimate for a generator and 500-hp. Pelton-Francis water turbine for 75-ft. static head and 70-ft. effective head with 200 feet of steel pipe for penstock, wire for transmission line and all material necessary for the plant except poles and building is \$36,000 f.o.b. Bonners Ferry. It is estimated that the cost of poles, labor, buildings, etc., will cost \$20,000.

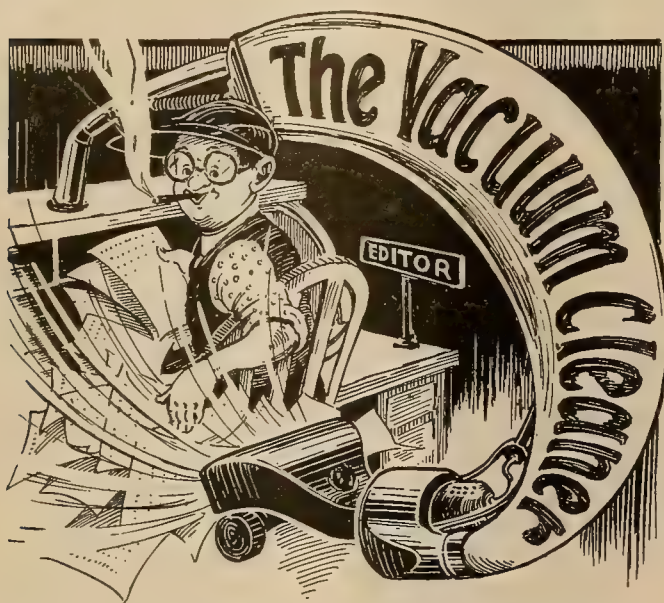
OGDEN, UTAH.—Through the installation of electrical pumping equipment, it is believed that Ogden's water supply can be greatly increased by pumping at the city wells in Ogden canyon, and through thus accelerating the flow the city need not look for other sources for years. It is believed that beneath these artesian wells there is a huge reservoir of water, and an almost unlimited supply can be obtained through forcing the water to the surface with compressed air, and the cost would be comparatively low. Before it is decided to purchase permanent pumping equipment, tests will be made by the city in August with an air compressor and electric motor tendered by the officials of the Amalgamated Sugar Company. This equipment will be loaned to the city without charge, and the tests will cost practically nothing.

SALT LAKE CITY, UTAH.—Answer has been filed with the state public utilities commission by the Telluride Power Company to the complaint made by the town of Milford that it has been overcharged for electric current. The power company sets out that in the past the electric service for the municipal pumping plant at Milford has been supplied under a special flat rate which is not included in any of the published power schedules of the Telluride company. Last December the company notified the town clerk that beginning with January the power would be charged for under schedules 7 and 8, which have received the approval of the public utilities commission, and that the town has been billed accordingly. The company claims that the charges are legitimate, and must be made in order that the service may not be supplied at a loss.

SALT LAKE CITY, UTAH.—A meeting of the Utah Water Users' Storage Association was held in this city on July 27th. At this time A. F. Parker, chief engineer of the association, set forth suggestions with regard to the utilization to the highest degree of efficiency of the waters of Provo and Weber rivers systems in the irrigation of lands in the eight counties clustering around Salt Lake City, Ogden and Provo. The executive board of the association has voted to ask the eight counties in the district to continue their appropriations to the work of the association for the current year. During the discussion of Mr. Parker's report it was brought out that surveys have been made on both the Deer Creek and the Hailstone sites, on the Provo river. Mr. Parker expressed the opinion that both will be found to be feasible for reservoir purposes. As to the Hailstone site, which would submerge the present Murdock power plant, he hazarded the guess that when the field notes have been plotted, it will be found that this reservoir will hold about 40,000 acre-feet, with a dam from 100 to 125 feet high.

VELOCITIES

It was stated on page 86 of the July 15th issue of the Journal of Electricity that the velocity of light is 186,400 miles a second, whereas that of electricity is 284,500 miles a second. According to present theories on this subject, on which much of electrical science is based, the velocities of light and electricity are the same. The error arose from a newspaper item which was clipped as a curiosity and which found its way into the pages of the Journal of Electricity without the necessary explanation.



The cure for all ills of modern civilization is the abolition of power companies, according to the following astonishing document, which is an extract from a letter recently received by the State Supreme Court of California:

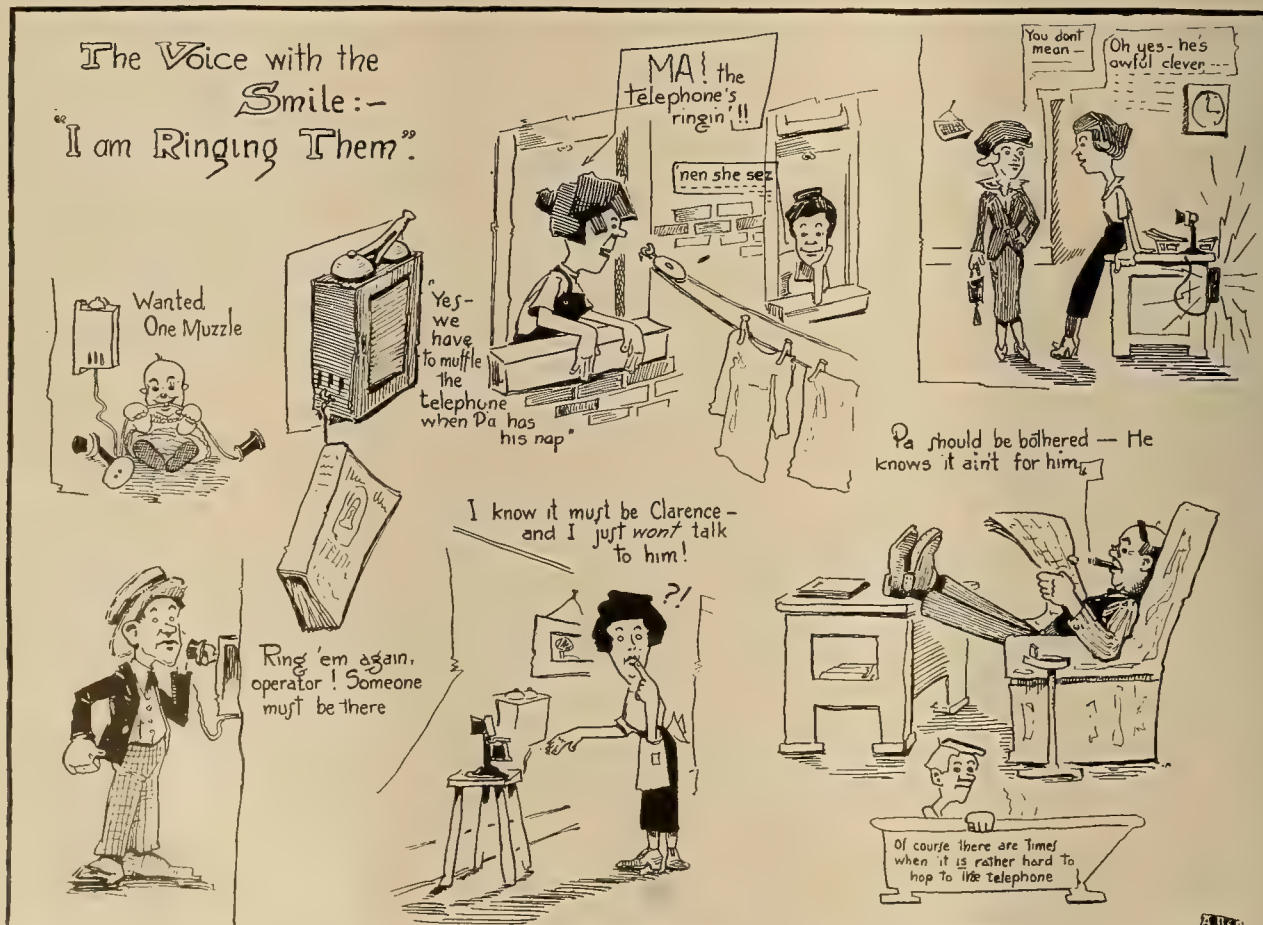
Surface current of atmosphere extends about two miles. Above this a current blows 100 miles an hour from Equator to Poles vessels superheated by Sun Ray, explode, those coming into shade collapse into water particles. Appetite of rarer air for vapor exhausts heat of fluidity of water particles congealing them into ice morsels, abounding above and between the vapor clouds. These entering higher air current are conveyed to and deposited round Poles, to fulfill Dan'l vii. 23, 2nd Peter iii. To avert which Adam was created, with reason. Vapor is practically opaque to radiant heat, which escaping from exploded and collapsed vessels, is absorbed by vapor, eventually giving tension downwards, preventing evaporation of all surface water. This resistance overcome, vapor will ascend to any altitude and quantity giving rain at request—D.V. Increasing ice caps force water through Planets Strata. Under heat and pressure water

dissolves sand forming great Caves or Mines. Coming on heated interior water is changed into Negat Electrified Steam. Negat Elect'y escaping from interior or forced therefrom by Dynamos by removing tension cause quakes and volcanic action. By Solar Reflection or contrary air currents liberating Latent Heat a partial Vacuum forms into and toward which vapor laden air flows giving off Latent Heat which enters adjacent vessels imparting tension downwards, being least resistance, forming whirl of reflecting to and fro interior air sweeping ground and Neg Electrified enters and ascends in whirling Cone, as Tornado, distinctive by rapid motion within whirl. A harmless Tornado can be formed by Fan and Horn giving rain almost anywhere. Accumulating ice caps are crushing in Planets Crust to break in pieces explode and Conflagrate her. This due to ignoring God's Law given instead of Adam's Lost Reason. Ice Morsels impelled outward by impinging Solar Ray. I reason after manner of radiometer, eventually yielded Electric to Gravitation attraction and caused The Deluge pouring Jupiter and Mars water in great part onto Earth. Mars I reason is dead and Jupiter in Conflagration. Telegraph Currents induce Compensatory Currents in ground, supplementing Trolley and Polar Pressure to kill all inhabitants of globe by Flu, Sleeping Sickness, Spasmodic Contraction of Heart, Insanity, Apoplexy or Paralysis. Remedy:—Suppress Electric Companies. Fix fine points on summits of iron and steel structures to diffuse upward. Bring rain on deserts to disperse Neg Electy and establish Vapor connection between Equator and Poles to relieve Polar Pressure. * * *

Why strike for a six-hour day when an eight-hour day works out so much more satisfactorily? Some one has made the following interesting calculation, which should certainly make people reluctant to change the present blissful arrangement:

	Days
Every year has	365
If you sleep 8 hrs. a day it equals.....	122
This leaves	243
If you rest 8 hrs. a day.....	122
This leaves	121
There are 52 Sundays.....	52
This leaves	69
If you have half-day Saturday.....	26
This leaves	43
If you have 1½ hrs. for lunch.....	28
This leaves	15
Two weeks' vacation	14
Which leaves	1
And this being Labor Day: No one works.....	1

SO YOU DON'T WORK AFTER ALL.



The telephone company is evidently "on to" us. This picture appeared in a recent issue of the Pacific Telephone Magazine.

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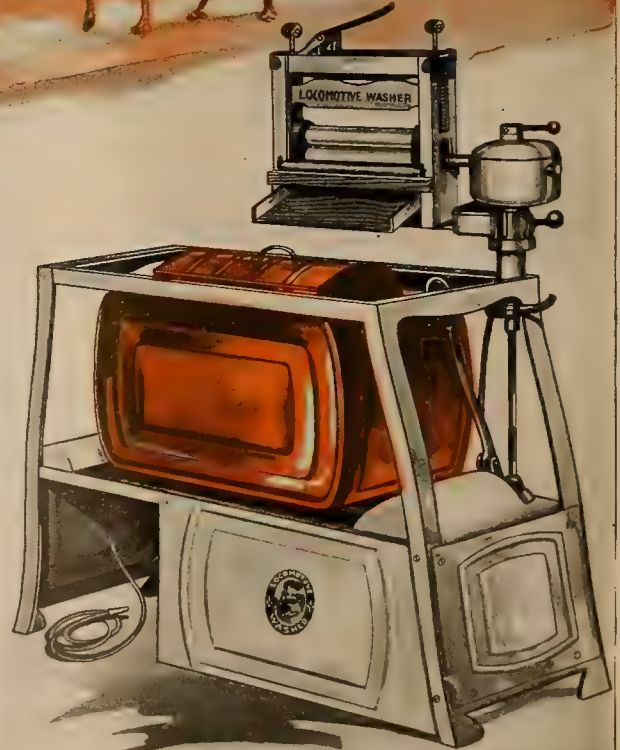
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JOURNAL OF ELECTRICITY

FOUNDED 1887

ROBERT SIBLEY, Editor

H. W. L. GARDINER, Business Manager

VOLUME 45

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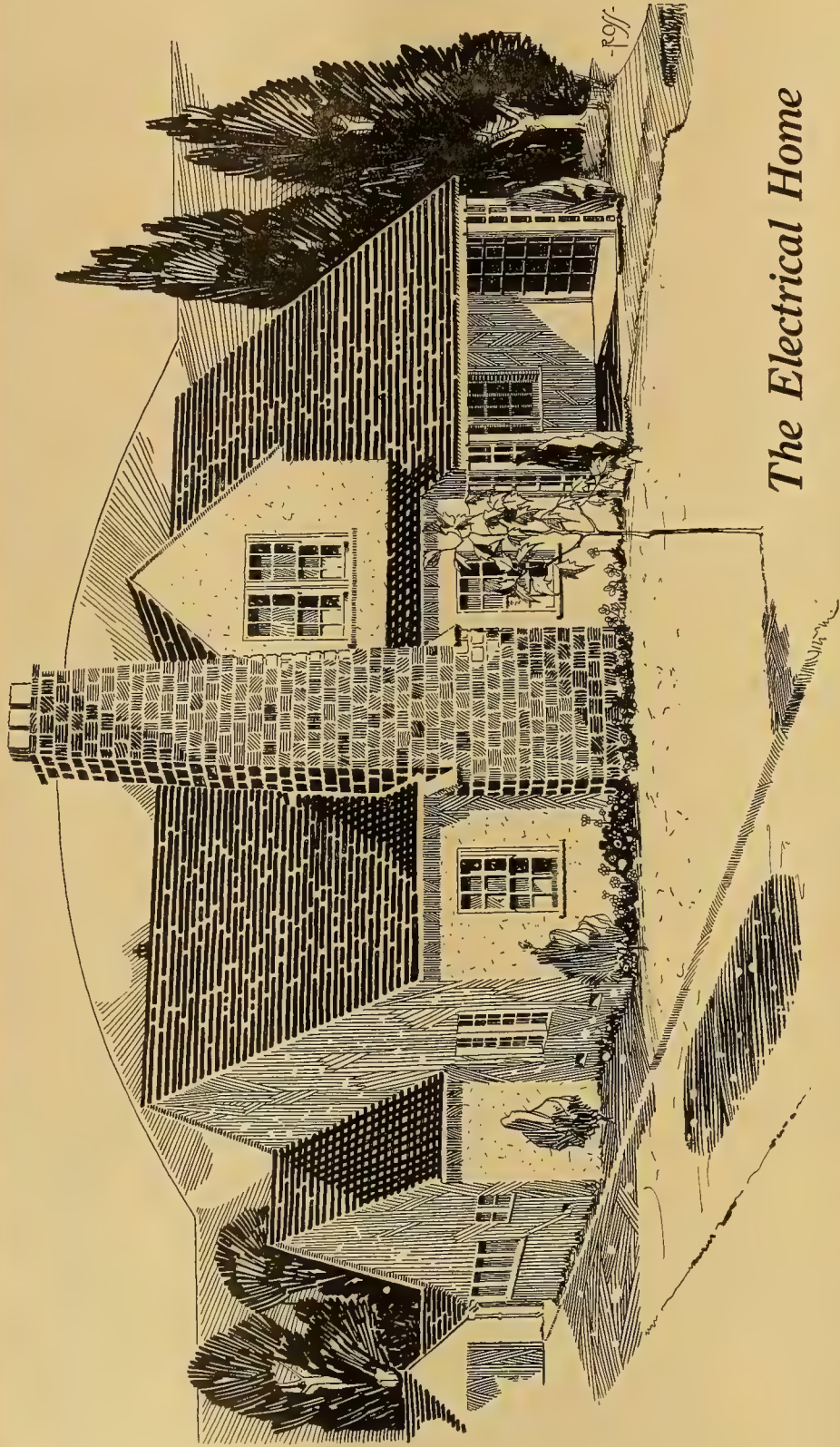
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The Electrical Home

With an estimated sale of two billion dollars' worth of electric appliances in 1920, the prophecy is made that the household use of electricity will prove the most promising field for development open to the electrical industry. In its educational value and concrete results, the Electrical Home movement, the latest contribution of the West, is perhaps the most significant step taken by the electrical industry in recent months. It is estimated that the

Electrical Home at Sacramento, California, shown above, will be visited by over 10,000 people—and this is only one of a series of twelve or fifteen such demonstrations which are being staged by the electrical men and real estate firms of California.



JOURNAL OF ELECTRICITY



DEVOTED TO THE UPBUILDING OF THE ELECTRICAL INDUSTRY IN THE WEST
AND IN THE COUNTRIES BORDERING THE GREAT PACIFIC

Volume 45

SAN FRANCISCO, AUGUST 15, 1920

Number 4

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SOMETHING TO THINK ABOUT

A MOST astonishing prospect is opened by the applications recently filed by the city of Los Angeles with the California State Water Commission covering practically all the water power remaining available in the southern portion of the state. This commences with the watershed of the Tuolumne River and includes almost everything pictured on Geological Survey maps from there southward, among the list such items as Illilouette Falls in Yosemite Valley, the Tuolumne River above the Grand Canyon, Thousand Island Lake below Mt. Ritter and other scenic beauties which it will be a surprise to many to learn are considered as open for power development. Something like a million horsepower are involved in the applications.

Aside from the protest which special features of the scheme will undoubtedly call forth from the Sierra Club and from others who have enjoyed these portions of the Sierras, a contemplation of the possibilities involved in the scheme as a whole is even more astonishing. It may be, of course, that Los Angeles is not intending actual development of all these projects, but merely establishing priorities until such time as it can determine what it wishes to do; it may be that the Water Commission will not grant the application; it may be that Los Angeles could not put through a bond issue which would finance such an undertaking (it is obvious that some \$300,000,000 would be needed to put this power on the market), but all these matters are beyond the point.

The question of major importance is whether a municipality shall now or at any later time be allowed to go into the power business outside of its own territory on a purely commercial basis. It is plain that Los Angeles cannot intend this 900,000 hp. solely for its own use. As a matter of fact, it is already in possession of power rights on the Owens River on which it has not pressed development. On the other hand, the major portion of the San Joaquin Valley and all of the southern portion of the state is dependent for its ultimate development upon just these water powers for which Los Angeles is making application. The resulting picture is one in which Los Angeles furnishes the power to all the lower half of California, either directly or by wholesaling it to the power companies, and in which this district is dependent upon the voters of that city for the bond issues, the city government and the engineering management which shall determine the valley's development. In such a case, it is conceivable that San Francisco might take a similar step in northern California and Portland and Seattle follow suit farther north, which would place the development of this coast in the hands of its large cities. Is the West prepared to entrust itself to this directorship?

It is estimated that two hundred thousand people will visit Electrical Homes in California by the first of the year, and that all of \$14,000 will be spent in advertising the campaign through the newspapers, two-thirds of it by real estate firms. What is more, this money has not been donated in charity nor in the interests of a sister industry, but from the only sound motive for spending money in business, that of self-interest.

These figures are impressive as showing two concrete results of the electrical home movement. Perhaps even more significant in indicating the success of the campaign is the announcement by one of the real estate firms involved that it is to adopt the permanent policy of building electrical homes. In other words, the returns from this campaign are to be cumulative in effect—it is a movement started, rather than a campaign for its day alone. It matters little whether these homes contain all the details in extensive wiring of the original; the point is that the electrical home idea is developing on its own merits

without any subsidy from the electrical industry, simply by virtue of its commercial value.

Equally important is the report of two private homes which are being erected in Chico, the wiring of each of which is to cost more than \$1,000. In Oakland, one firm is putting in 150 homes, all of them wired for electric ranges. With the home builder, both individual and commercial, interested to the point of actually putting the lesson into practice, the Electrical Home Campaign appears to be a success.

The uniting of the National Electric Code, which is commonly known as the Fire Code, with the Electrical Utilization Safety Orders is the gigantic task being attempted by the California Industrial Accident Commission, with the help

California's Combination Code

of a committee which represents all branches of the electrical industry. This movement should be backed by all the members of the industry as it will lead to an easier interpretation of the two codes which at present are extremely vague. A new form should be

adopted which will permit the grouping of all rules relating to a specific subject under the title of that subject, and the subject titles should relate to the classification of the installation. In other words, if a contractor was working on conduit he could look up that subject in the index and find all of the rules regarding the installation of conduit in one group.

The recommendations contained in the provisions of the Fire Code should be made mandatory by the Industrial Accident Commission, and the combination of the two codes should be revised as often as the National Electric Code is revised in order that the people of the state of California may have the maximum protection. In order to eliminate the cost of duplicate inspections by the state it has been suggested that the proposed code directly recognize the labels issued by the Underwriters' Laboratories, both fire and accident. It is folly to suppose that the people of California would allow the Accident Commission to set up such an expensive thing as a complete testing laboratory, which would be a considerable drain on the state treasury, when complete tests that have always been satisfactory are being made by the Underwriters' Laboratories.

If the ideas expressed above are carried out in the combining of the two codes it should not only prove of value to the different branches of the electrical industry in the simplifying of their work, but of great value to the people of the state of California, assuring them of a double check on the methods used in the wiring of industrial and manufacturing plants. If such a bill will make the work of the Industrial Accident Commission easier or more efficient in cutting down the loss of life and property from electrical causes, it is to the best interests of the industry to support it. The more the general public realize that the electrical industry is producing absolutely fool-proof and safety first appliances, and is doing all that it can to safeguard life and property, the greater will be the general acceptance of electrical appliances, and the abolition of the fear that most people have of things electrical.

According to an ancient proverb, you can "lead a horse to the water but you cannot make him drink." The spirit of the remark can equally well be applied to a woman—some women—and electrical labor-saving devices. A few women do not use electrical appliances because they cannot afford them, but a far greater number ignore them because they were not brought up to use them, and their mothers "got along very well without." This adherence to what one has been used to, however, works both ways, and will be an important factor in perpetuating the work accomplished by the house management course described on another page of this issue.

In this course the student is transported to a model home where electric appliances are taken for granted. Here she not only uses electricity continually but learns also to execute minor repairs, thus

getting beyond that "mystery" with which so many women invest everything electrical.

In the definite linking up of electricity with domestic training lies a great opportunity both for the electrical industry and for the educational institutions. Cooperation between the two will accomplish much for the promotion of the electrical home idea, and for the betterment of the conditions of daily living in the community.

It is difficult to overestimate the value of this kind of training, and its future possibilities. There are today about 470 universities and colleges in the United States, and something over 12,000 public high schools, to say nothing of innumerable other educational institutions, public and private, of all kinds. Great numbers of these conduct domestic science departments, but comparatively few have introduced electrical household appliances into the work of these departments. In the active promotion of the idea lies one of the greatest opportunities to turn to good account that innate conservatism which clings to the tools to which it has been accustomed, and to make the electrical appliance indispensable to the housewife of the future.

Not the least of the advantages of the Electrical Home plan is the opportunity which it offers to the electrical contractor to formulate ideas on good practice in house wiring. The very speed with which the electrical industry has grown has left the contracting branch of the industry little time to devote to keeping up with the latest theories, and part of the poor house wiring which has been done in the past has undoubtedly been due as much to the fact that the contractor did not suggest better, as that the householder or the architect could not be sold the idea.

The electrical homes, as wired, are not intended as models of every new device on the market, and undoubtedly they could be bettered in detail by those who have studied out special features of especial convenience, but they do represent houses modernly wired along well thought out lines. The campaign is one of education—and the electrical industry may benefit as well as the public.

One of the principal points brought out in the discussion during the recent Pacific Coast Convention of the American Institute of Electrical Engineers at Portland, Oregon, was that the engineers of the power companies do not and have not received equal consideration in their affiliation with the Institute as have others in their organizations such as the commercial men received in connection with their affiliation with organizations such as the National Electric Light Association. This is in no way to the discredit of either the companies, the commercial men or the attitude of the companies toward the National Electric Light Association. It

Education and the Electrical Home

Electrical Engineers' Convention

is eminently proper that the greatest encouragement be given to the vital work of the N. E. L. A., but it is equally important that the greatest consideration be given to the Institute, as it is an association of greater value to the engineers than is the N. E. L. A.

An engineer's most valuable education and training is received after he has left college, and entered practical work. Either through habit or necessity, an engineer is somewhat of a recluse, and he is too often given to being backward in his demands for those things justly due him.

It therefore behooves the engineer to insist that the greatest consideration be given him in the affiliation he has with engineering societies, and the companies should recognize the necessity of their engineers taking every opportunity to meet with their fellows and gain the experiences of them all.

The recent increase in freight rates of 33 1/3% which will become effective on the Pacific Coast August 20, will have a direct effect on

The Increase in Freight Rates the electrical industry, increasing the cost of materials as it does.

It will increase the cost of all materials which the Pacific Coast states have to import from the East, and while it will no doubt retard the building industry it should have the effect of stimulating manufacture. With the promise of plenty of power for next year there is no doubt that eastern manufacturers will be forced to establish western branch factories if they are to hold the trade of this section of the country. Whether this condition of high freight rates is to continue or not makes little difference providing that the people of the West see this opportunity to foster home industries and make the West independent of eastern manufacturers, car shortages, and still higher freight rates. To the electrical industry it means an opportunity to build up a large, desirable industrial load, proving that it is indeed "an ill wind that blows nobody good."

The almost unanimous demand by public utilities for increased rates has concentrated attention as

Distribution of Rewards never before upon the function of the public utility, its relation to the community, the methods and extent of its service, and the or-

ganization and distribution of its finances. The public is being brought to see by every possible means that improvements and extensions are essential if a utility is to keep pace with the demands made upon it, and that in the last analysis financial disability is reflected in inadequate service to the consumer. Conversely, it is apparent that in return for the higher rates the consumer tends to expect better service, and the question arises as to how the power company can meet this expectation in such a way as to create steadily increasing confidence and good feeling.

It has been maintained that increased rates allowed to power companies should bear some rela-

tion to the individual company's efficiency, and to the degree of its service to the public. This principle is based on a recognition of the stimulating effect of the reward for efficiency, and virtually pledges the company so to distribute the reward that it really has this stimulating effect. A power company is a complex organization, and a large number of factors contribute to the quality of its service. The relative value of these is a matter for individual decision, but the general principle of equitable distribution of reward among employes must necessarily play a large part in maintaining efficiency, and in building up the type of service the public has been taught to expect.

The personnel of a public utility is fundamentally the most important medium through which service is rendered. It is therefore a matter of self-interest for the company to consider from this point of view the allocation of its funds subsequent to an increase in rates, always aiming to apply them at the points where they will have the greatest stimulative effect, and will best meet the public expectation of constantly improving service.

Typical of the business situation in the West are the building records of Los Angeles and San Francisco for the first half of the present year. From January 1st to June 30th there were issued in Los Angeles 11,634 permits, valued at \$29,318,689—an amount greater than for the entire year of 1919. Of this some \$12,000,000 was expended on industrial plants. In San Francisco there has been launched since the first of the year industrial construction calling for an expenditure of \$5,208,300 for building alone, exclusive of equipment. These figures, while they obviously indicate a building boom, have a significance far beyond their immediate application.

No indication of general business activity is of greater interest and importance to the electrical industry, both directly and indirectly, than this phenomenal building program. Figures show that 142 industrial firms and corporations have opened up new establishments in San Francisco, or increased the size and capacity of existing plants, in the last six months, and in these days every new industrial plant means extensive electric wiring and lighting, and complete or partial electrical equipment for operation.

Figures for residence building also show a marked and rapid increase since the beginning of the year, and indicate an unlimited field for wiring, for the sale of lamps and appliances, and for increased power service. It is always among the builders of new homes, where there is no question of the inconvenience of re-wiring, that the doctrine of the electrical home will have its strongest appeal, and the present building activity is furnishing a unique opportunity for the establishment between architects, builders and the electrical industry, of the cooperation which has lately been the subject of so much discussion.

In addition to industrial and residential construction, building permits show large numbers of office buildings and theatres under way, all of the most modern type and demanding exceptional and often elaborate illumination systems.

Figures from New York reveal a decrease in building activities, owing to the high price of labor and materials. In the West these obstacles seem to have been powerless to hamper the overwhelming activity. The general situation is doubly important as showing the increasing attraction which the Pacific Coast has for eastern capital, and provides a most optimistic outlook for the electrical industry west of the Rockies, where so much large-scale electrical development is already planned for the next ten years.

In spite of minor depressions, business men look upon present conditions with some optimism. There

Outlook for Business Conditions

is no question but what the consumer demand in many lines has lessened of recent months, particularly in the field of household

devices and wiring material, largely as a result of the delayed building activities in the country as a whole. On the other hand, there are no surplus stocks of these materials on hand and the slack period allows production to catch up with demand. The restricted credit situation is looked to to clear up by fall. Labor conditions seem to have turned the corner for the better. Although transportation conditions are bad, railway equipment companies are busy, which would indicate that September will see new rolling stock available. The presidential election seems to have little effect on business one way or the other.

At the present time, perhaps the most cheerful aspect of the situation is the fact that the public is

coming to realize that the price cutting sales of early summer were not part of a permanent price reduction movement. It is being recognized that there can be no sudden drastic reduction in prices, but only as production conditions make lower levels possible. While abnormal profits have been made along some lines, in the aggregate prices have borne a direct relationship to the cost of materials and labor, the realization of which fact is tending to steady the public's buying.

In general, while the present conditions are far from good, business looks forward to a more optimistic tone in the fall with a revival of buying along all lines dependent on demand by the general public.

Extensive plans are under way in British Columbia for the inauguration of an electrical coopera-

The Cooperative Campaign Idea Spreads

tive campaign movement, the recent reorganization of contractor-dealers in Salt Lake in which

Inter-mountain jobbers are participating as well, is undertaking work in a true cooperative spirit, the Northwest is already making preparations for the formulation of such a campaign—in fact, it will not be long until all parts of the West will be covered by such organizations. The importance of this step in the improvement of merchandising methods and inter-industry conditions through all this region can best be measured by the success of the California movement, upon whose model most of these movements are based. The record is one of new stores opened and old ones improved, of old enmities wiped out, of constructive ideas put into practice. The West already stands high in the standards of its merchandising and the present campaigns of improvement outlined promise well for an even brighter future.

MONEY may be "the root of all evil," but it has other functions—for instance, the development of hydroelectric energy. The vital question of_____

Financing Power Developments

will be discussed in its several aspects in the September 1st issue of the Journal of Electricity. There will be additional features on

Progress in Hydroelectric Construction

The Cooperative Movement in the Northwest

The Convention of the Northwest Electric Light & Power Association



A residence of particular beauty is being built in Los Angeles to serve as a Home Electrical. With the interest already being shown in this project, together with the others being planned throughout the state, it is expected that 200,000 people will have visited Electrical Homes by the first of the year. E. B. Rust is the architect.

How to Put on an Electrical Home Campaign

(The success of the electrical home campaign has been largely due to the manner in which the undertaking has been handled. Several cities in California now have their demonstration electrical homes, and the following article outlines the workings and the results of these campaigns as carried on in California.—The Editor.)

The success of the Electrical Home which was featured in San Francisco during the latter part of June has definitely established the value of this idea as an advertising medium and has opened up a new field for the telling of the electrical story. The Electrical Home as here carried out was an attractive new residence in St. Francis Wood, which, with the cooperation of the Mason-McDuffie real estate firm and the electrical industry of the community, was wired in the most approved method to illustrate the value of the convenience outlet. In order fully to advertise this idea and to bring home to the public the unique convenience of electricity, an electrical exposition was staged in the new residence during the first three weeks, electrical apparatus and fixtures being donated for the occasion by electrical jobbers and manufacturers. An extensive advertising campaign announced the event, with such success that some 18,000 people visited the home during the time that it was open and many more who did not find the time to attend became acquainted with the electrical idea as an attractive and modern convenience, an essential to the most up-to-date comfort.

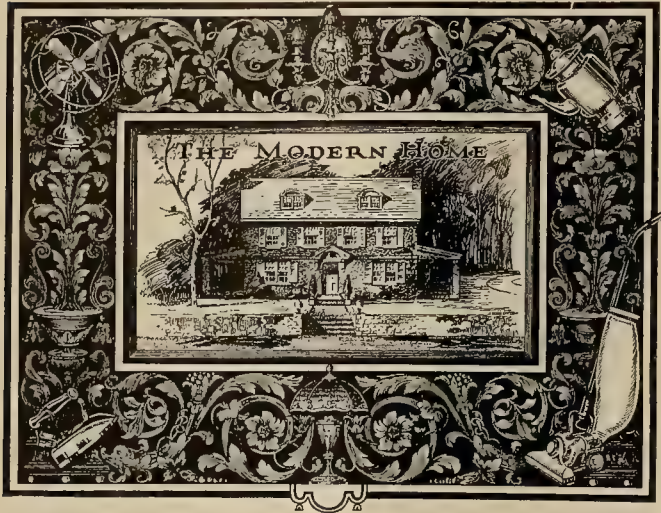
Model Electrical Homes

With the success of this initial experiment as an argument, the California Electrical Cooperative Campaign representative, in cooperation with the electrical industry in other parts of the state, has succeeded in arranging for the establishment of similar

demonstrations in several other cities. The J. C. Carly Company of Sacramento is devoting one of the most artistic of the new homes in its residence tract for this purpose, an electrical home is to be opened August fifteenth in the Lakeshore district of Oakland under the auspices of the W. H. Leimert Company, a Los Angeles home is under construction by the Wiley Edwards Company to be opened October first and similar homes are planned later in the season for Fresno, Bakersfield, Long Beach, San Diego and Berkeley, not to mention the other communities who will be interested but who have not yet been approached on the subject.

It is estimated that 200,000 people in the state of California will have visited electrical homes by the first of the year. This estimate is based upon the attendance at the San Francisco home and the interest which has been shown elsewhere where the projects are proposed. It is also estimated that \$14,000 will be spent directly in the newspaper advertising of these homes in the same period, two-thirds of which or over \$9,000 will be spent by the real estate firms carrying out the projects. This does not take account of the extensive publicity which is carried on by power companies and contractor-dealers of the community over their own names, nor the generous advertising with which the real estate firm follows up the electrical idea after the official close of the campaign. When it is realized

that these campaigns have been staged at the strategic advertising points of the state, whose newspapers are distributed over wide areas outside of the local communities, the wide-reaching nature of this movement becomes apparent. The San Francisco papers cover the entire northern portion of California, as the Los Angeles papers cover the south. Similarly the papers from Sacramento, Fresno, and San Diego—in fact, all of the cities selected, have a wide



Booklets on the possibilities of electricity in the home are issued by the Society for Electrical Development and other organizations and are to be had for the asking or at cost. This attractive pamphlet is prepared by the N. E. L. A. and could be used to good effect in supplementing the advertising of Electric Home Week.

area of distribution, so that the entire state of California will be told the electrical story at least twice during the campaign.

The electrical home idea from the standpoint of the electrical industry, of course, is a method of spreading the gospel of the convenience outlet. No one, least of all the architect and the public itself, questions that the ideal home would contain all electrical appliances available and that such a house in building would represent the last word in wiring. The trouble is that no one ever has quite enough money to build an ideal home and the problem becomes one of selection between tiled bathrooms, hand-wrought door fixtures, patent furnaces and electrical conveniences. The lesson which must be taught is that it is not the model home so much as the average home which should contain these labor-saving devices and that only by proper and adequate wiring can the average home be comfortable in any modern sense. The electrical industry must sell the electrical idea to the public as the idea of open plumbing has been sold, so that the house which is inadequately wired will be as old-fashioned and as difficult of sale or rent as the house without a bathroom. It is obvious that the concrete embodiment of electrical convenience in a house actually for sale and featured as something especially desirable is the most effective argument that could be devised.

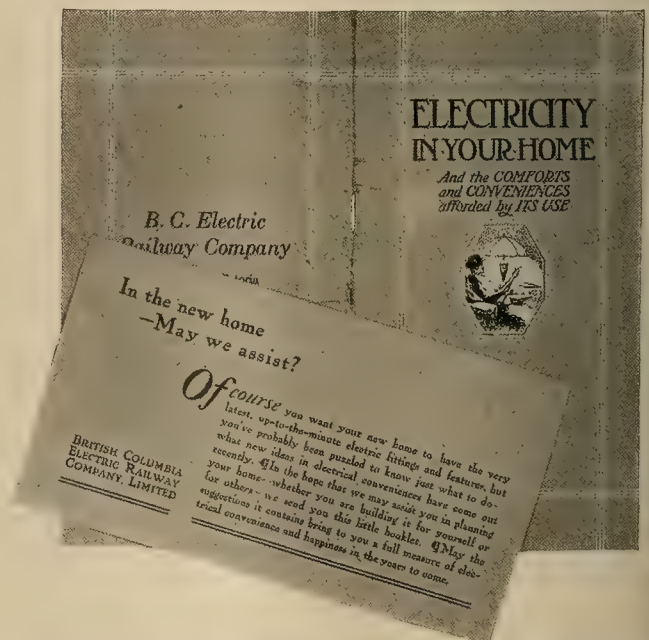
Appointing a Publicity Committee

Once the idea has been sold to the real estate firm, the problem becomes one of securing the best representation that can be secured of what electricity

can mean in comfort. It is, of course, the place of the electrical industry of the community to make plans for the best presentation of this story. This is usually placed in the hands of a committee of electrical men, either from the electrical club of the community, such as the San Francisco Electrical Development League, or from the local Contractor-Dealers Association. The advantage of having the responsibility in the hands of the contractors is, of course, that the very ones who are to be involved in the later wiring of electrical homes which may result from this movement are associated with it from the beginning and get the value of its educational features, as well as receiving the definite publicity which connection with this movement brings in the eyes of the public.

The committee consists of a main group which supervises the entire plan, with sub-committees on finance, publicity, wiring inspection and house arrangement. The duties of most of these are to be judged from their titles. The committee on wiring inspection is responsible for seeing that the house represents the last word in electrical installation, the committee on finance secures promise of donations from all branches of the electrical industry to cover the expenses involved, while the publicity committee is responsible, not only for the newspaper and other advertising which it put out, but also for the publicity stories which are secured in the daily press.

The house arrangements committee has two distinct functions, the securing and installation of appliances and the actual running of the home. This latter function has been variously managed in the



The importance of home appliances as load builders has been appreciated by the British Columbia Electric Railway Company, Ltd., who send out a little pamphlet and announcement to prospective home builders.

different communities, but in general means that one man has charge of the house during the entire period and that under him, one man is assigned to each room so that there will always be someone to answer questions and to tell the story of the convenience outlet. Probably best results can be secured by having these

men serve for fairly long periods, so that too many people need not be broken in to tell the story. This means that the services of these men are donated by their respective companies, but the investment is a good one in the concrete returns which it promises as well as in the benefit to the man himself. In Sac-

ramento the equipment will be fully connected, of course, so that it may be set in operation at any time for those who inquire.

Methods of Advertising

The costs of advertising are shared by the real estate firm and the electrical interests of the community, in the ratio of two dollars spent by the real estate firm for newspaper advertising to every one by the electrical industry. In addition bill-boards in prominent locations tell the story of the Electrical Home, it is proclaimed by colorful street car cards and window cards set up in every available window. In addition to this, considerable direct-by-mail circularizing is carried out, this taking the form generally of invitations to visit the home. These are extended to members of clubs and classes, as well as to individuals looked upon as prospects, either by the real estate firm or the electrical concerns of the city. A most important branch of this circularizing is the invitation sent out by the power company to its subscribers. Not only are these the people in the city most interested in advertising, but the circular, arriving in the usual envelope of the power company, is sure of attention.

In Sacramento a special feature is to be made of the opening day, the Governor of the state officiating at the ceremony, which is to be attended by the city executive and other prominent officials. Throughout the demonstration, cars running to this district will bear signs proclaiming the fact that they run direct to the "Electrical Home." Similar advertising campaigns will be carried on in each of the cities contemplating such a demonstration.

Mutual Benefits

The Electrical Home costs both time and money on the part of both parties concerned, but the returns promise full recompense for both. The real estate firm has found an excellent advertising medium—a means of attracting 18,000 people to its residence tract in a dignified way. A buried treasure in one of its vacant lots would undoubtedly secure a crowd—but its name would thereby be connected with the bizarre, rather than the progressive, as with this arrangement, and the people attracted would not be those who are interested in home building or purchase. To be sure, all those who attended the home electrical were not prospective purchasers, but surely few persons in San Francisco who planned the building of a home of any consequence in the near future failed to take advantage of this opportunity to see just how wiring should be done.

From the standpoint of the electrical industry, the story of the convenience outlet has been told in the most effective way. The idea of the electrical home as the next new development in modern living conditions has been presented by the foremost realty concern of the community in a manner which shows that they believe it to be a commercial possibility. The idea has been sold, not only to individual members of the community who will be putting in more extensive wiring in homes of their own, and to rival real estate firms who cannot afford to put inferior houses on the market and who must in some measure

The announcement which appeared in the papers following the campaign, that the Mason-McDuffie Company will hereafter make all their homes "Electrical Homes," is one of the most significant results of the San Francisco experiment.

ramento this is so keenly felt by the contractors who are handling the movement that men are to be assigned regularly by the different contractor-dealer establishments in town to take charge of demonstrating the house during the day, and at night the dealers themselves are to be present to meet visitors. Each man will wear a card, bearing his name. It is obvious that the publicity thus gained and the personal contact with just those people who are most interested in electrical ware, will have its later value.

Appliances in Use

The electrical exposition as a means of bringing people to view the home has justified itself in the results which it has secured. Of course no mention is made of the particular makes of appliances displayed, which will probably be chosen by lot so that no question of favoritism can be involved. In the San Francisco home the various equipment was demonstrated, laundry continually going on in the wash room, meals being cooked in the kitchen and on special occasions, tea served in the breakfast room. The experience of this experiment has shown, however, that it would probably be wiser not to demonstrate the equipment but to focus emphasis on the convenience of connection and to let the mere presence of the appliances tell its own story of electrical comfort possible. Pamphlets featuring the convenience outlet idea will be at hand for those who wish to pick them up and neatly lettered cards above each appliance will give the cost of its operation in terms of local

follow the new idea, but the idea will be sold to the real estate firm itself. The announcement by the Mason-McDuffie Company that hereafter all residences built in St. Francis Wood will be electrical homes, is perhaps the most significant result of the experiment in San Francisco. It places the "Elec-

trical Home" in the place where the electrical industry desires it—not a model to be looked upon as an unattainable ideal, but a working thing, so practical and desirable that it is being carried out—and sold—by an important concern to people who are discriminating.

Advertising the Electrical Home

BY H. C. HOPKINS

(An idea, like a product, must be advertised, and advertised not spasmodically but continuously and consistently. The comprehensive campaign carried on to advertise San Francisco's Electrical Home is here described by the chairman of the Publicity Committee of the San Francisco Electrical Development League.—The Editor.)

The publicity campaign for the San Francisco Electrical Home, handled by the San Francisco Electrical Development League, consisted of newspaper



Billboard advertising is one of the most conspicuous types of publicity, and conveys a brief but forceful message to the hurrying and unobservant crowds.

advertising, billboard advertising, window cards, street car cards, special folders and special invitations.

Newspaper advertising was carried in all six San Francisco newspapers, three morning and three evening dailies. Seven pieces of copy beginning with a 48-inch ad, continuing with a 30-inch ad and closing with a 24-inch ad.

The total number of inches of advertising in all papers was 796 column inches. While the advertising did not begin until June 11th, the opening day, considerable local interest was aroused and 831½ inches of news copy appeared in the San Francisco papers under dates of June 9th and 10th, so that the public interest had been aroused to quite some extent before the newspaper advertising appeared.

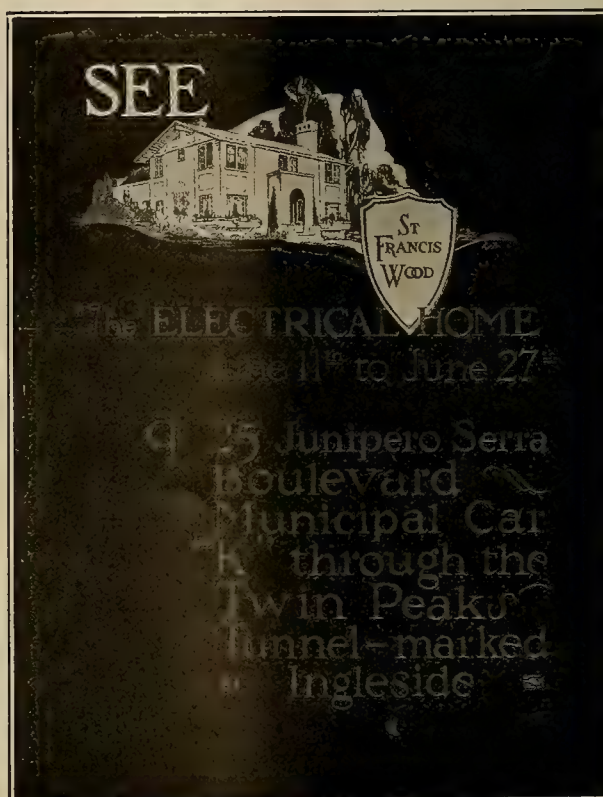
To catch the eye of the public, billboards were used, and a special design drawn up to convey the message appeared on eight downtown locations. This billboard advertising appeared a week before the newspaper copy made its appearance, and street car cards were run in all San Francisco street cars one week before the campaign started.

In addition to this a special window card was designed and 500 cards distributed to business houses of all classifications in the city and all merchants co-

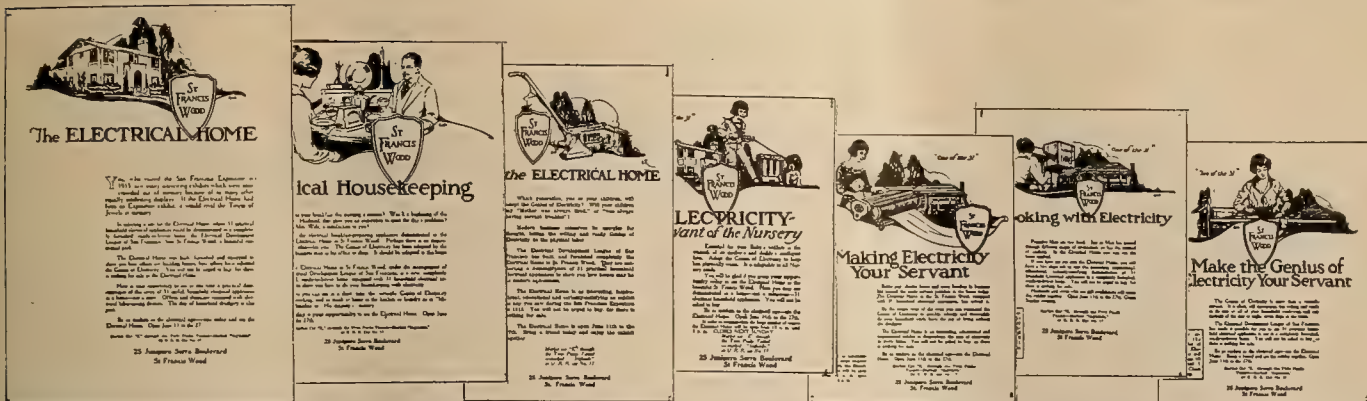
operated in displaying the card in their windows.

A special invitation was designed and sent to civic organizations, such as business men's organizations and prominent ladies' clubs and societies, and a three-color Electrical Home folder was run off for distribution to visitors at the Home. The design of the folder tied in with the billboard advertising and all other copy, carrying in addition to the cut of the Home, actual floor plans which showed the location of all electrical outlets including lighting.

The Electrical Home opened on June 11th for two weeks, the formal opening address being made by Mr. John A. Britton, vice-president and general manager of the Pacific Gas & Electric Company, to a gathering of over 200 visitors who had been specially invited to attend. The visitors consisted largely of city officials and electrical men. The opening address was responded to by city Supervisors W. S. Scott, chairman of the Building Committee, and Edward I. Wolfe, chairman of the Public Utilities Committee, all of the city government of San Francisco.



A bright card displayed in the windows of all electrical dealers caught the attention of those people most likely to be interested.



By consistent advertising, in all the San Francisco dailies, the publicity committee for the Electrical Home impressed upon the community's consciousness the idea that was being put forward. Only constant repetition in the most widely circulated mediums can achieve the desired effect.

Each day was given over to one of the city's clubs or organizations as well as the general public. The idea of the Publicity Committee in arranging for the reception of clubs or organizations on specific dates was principally to create interest among the very best people in the city, and also to create news so that the Home would be given a fair share of news mention in the newspapers. This worked admirably, as shown by the fact that during the two weeks the Home was opened to the public, it received a total of 4301¼ inches of news copy, some mention of the Electrical Home being made in all editions of all the papers from the time the Home opened until it closed officially on June 27th.

All electrical dealers and contractors tied in local newspaper advertising with the Electrical Home; in addition the Pacific Gas & Electric Company devoted their newspaper advertising space to the Electrical Home idea, cooperating to the fullest extent in every way.

The result of this comprehensive publicity campaign was to fill the Home with visitors every day

It has been amply demonstrated that the general public is ready for all the information which can be conveyed to them on the advantages of properly wiring the homes and the proper and efficient use of appliances. The campaign has been further responsible for a new outlook among architects and builders, who are beginning to realize the advantages to be gained by wiring homes in anticipation of the awakening which is sure to come.

As one swallow will not make a summer, so one Electrical Home will not put across this big idea. It must be followed by other Electrical Homes on a larger and better scale than this one and the idea must be copied and followed in every city. It is the cheapest form of advertising for the general education of the public, and can only result in advancing the interest of the electrical industry by showing people the numerous devices properly applied that have been developed, for increasing home convenience and reducing home labor.

ELECTRIC LIGHTS AND EGG PRODUCTION

Some very interesting experiments have been performed by Prof. W. E. Schoppe, poultry expert of the Montana state experimental farm, along the line of increasing egg production by the use of electric lights in the chicken coops. Two flocks of hens of the same variety were put into separate pens and given the same treatment and feed except that in one of the coops electric lights were placed that were lit from 6 a.m. until dawn and from dusk until 9 p.m. It was found that the hens in the lighted pen needed more feed than those in the other pen but this extra cost was charged against them. During the month of November the unlighted pen showed a loss of 41½c. per bird while the lighted pen showed a profit of 24c. per bird, and in December the unlighted pen showed a profit of 11.5c. per bird with the lighted pen showing a profit of 59.2c. per bird.

The test was continued for a period of ten months and during that time the profit from the birds in the unlighted pen was \$473.80, while the birds that had been kept in the electrically lighted pen showed a profit of \$568.19. It should be noted that the record speaks of profit and not production, and shows that the hens in the lighted pen produced a higher profit after making full allowance for the extra feed and for the cost of the lights.



Samples of the attractive colored folders used to advertise the Electrical Home. The upper one was used for the Sacramento home, the lower one for the San Francisco home.

to such an extent that the work of properly demonstrating and explaining the modern features of the Home was somewhat hampered. So popular did this become that during the two weeks it was open officially, over 18,000 people visited the premises.

The Architect's Viewpoint

BY HENRY H. GUTTERSON

(Without open discussion no good work can proceed, and it is essential in the promotion of the electrical home idea, which needs the cooperation of several industries, that the viewpoints of all concerned should be brought forward. The author of the following article was architect for the San Francisco electrical home at St. Francis Wood.—The Editor.)

Even the most casual perusal of history brings out the fact that the architecture of any period or people is a very accurate expression of their tastes, economic status and habits of life. Following out this fact in its present day application, we put our finger on the reason for the highly individualistic, cosmopolitan and unstudied design of the last decade. We have in each community exactly what we are ready to appreciate and maintain; portraying false ambition, extravagance, grossness, or refined restraint, thrift and good taste as the thought of the people dictates.

So it so often becomes true that the criticism launched against architects and builders is misdirected or overdone. They are, after all, but individuals in the community, building to satisfy community needs and ideals—not dictators in such matters, leading the people by the nose. Their function is much more largely that of educators than is generally appreciated. When they fail in this, their greatest opportunity, they either egotistically express something so radically new and individualistic as to be out of tune with their community, or lazily drift into banal repetition of discarded ideas for monetary gain or through sheer ignorance—both of which courses are as short-lived as the community dictates.

The New Simplicity

In a recent trip through Southern California, the writer was much impressed with a new and flourishing style in the domestic architecture. The Spanish colonial work of Mexico and the more pure and refined styles of Spain and Italy had been skillfully adapted to this region where climate and setting made the adaptation easy and logical. During the last few years through careful educational work the architects, decorators and landscape gardeners have been helping their community to see the beauty, comfort and economy in this new American, or California style—for it is new in its adaptations. In four years the whole character of the demand in houses, gardens and furnishings has undergone a radical change, a real growth toward something more permanent, just as the people have adjusted themselves.

The Need for Economy

One of the greatest factors in this advance step has been the economic factor—a demand for simplicity to offset high costs. It has been an easy thing to demonstrate that the extremely simple, square lines and details of this style are compatible with economy. Another great factor has been the so-called servant question that has so universally demanded simplification in the upkeep of the home. This, too, has been cared for in the structure and detail of this new style with the elimination of ornate

moulded woodwork and built-in features, the use of easily maintained interior color schemes, floors with but little covering, and labor-saving mechanical devices. It is not a mere fad; it is not an achieving of some desirable effect extravagantly, but an appeal to reason, through economy and good taste—a sane simplification made doubly beautiful.

The average home builder of today is not in the mood to take up with fads, however attractive. The thinking public finds conditions, the world over, far too uncertain for indulgence of ideas that merely look or work well. So, anything new in the home must not only merit support but that support must appear easy to give and maintain, if necessary.

As an architect, I find many times that there are numerous features that meet with my approval; that work well, that look well. But in my function of educator, it is always a third demand—that of simple economy—that counts with the client.

Cooperation to Meet the Needs of Today

Men of the electrical industry should not cross swords with the architect, builder, or even the owner on their apparent lack of cooperation. They should adjust themselves to the present day economic and social conditions and bend every effort toward simplification and economy. We are all convinced that electrical appliances for the home—and these are many—have come to stay. Put them within our reach! By "our reach" I mean the reach of the average small house builder or owner, for the wealthy still have most of the servants to ease their enthusiasm for labor-saving devices, and the poor are not building.

My short experience with home appliances has led me to believe that one of the best methods of reducing costs is a closer cooperation between the appliance distributors and the electricians wiring the house, in order to eliminate the present conflict of ideas and even ignorance as to wiring requirements. Another source of waste is in the lack of technical knowledge of those requirements among the architects. It would be well if the panel-board of an average house were kept so simple that it did not awe both architect and owner, for instance. Also, it would be well if all waste in wire sizes, circuits, etc., could be eliminated by cooperative educational work among all concerned.

The need for progress was never more urgent. The desire for it was never more prevalent. The basic conditions imposing economy, simplicity and permanence are fundamentally right. The day of intense individualism is past. Let us all strive for closer cooperation, with "Service" as our slogan, and all will be well.

How the Electrical Home Is Wired

LEGEND

□

Service Outlet

□

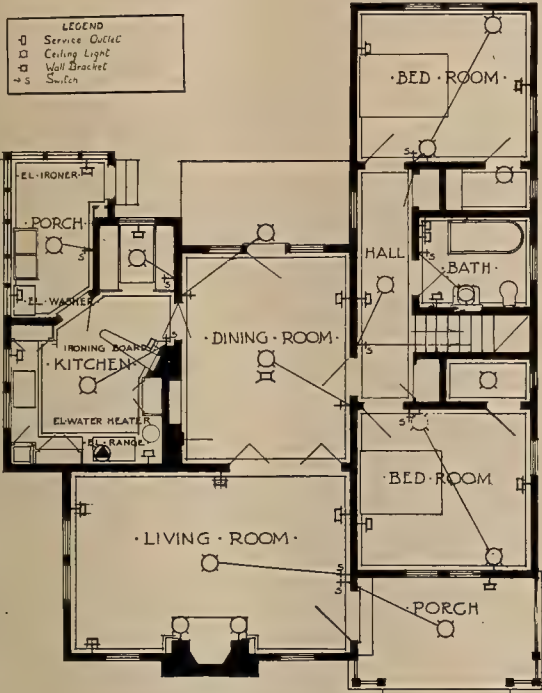
Ceiling Light

□

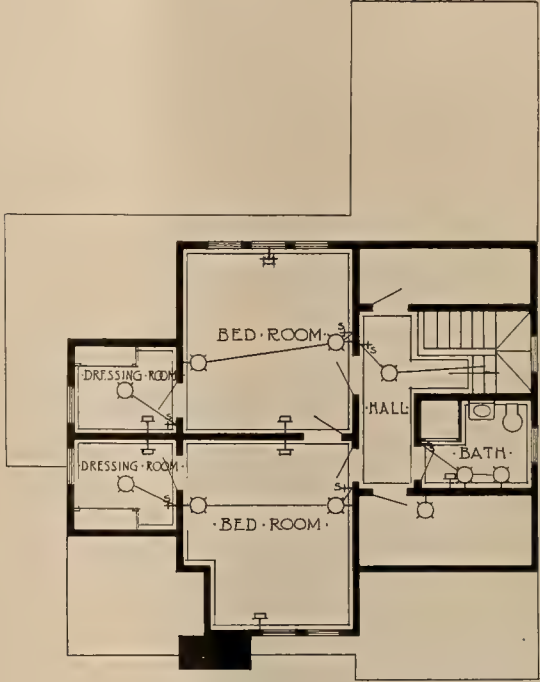
Wall Bracket

→ S

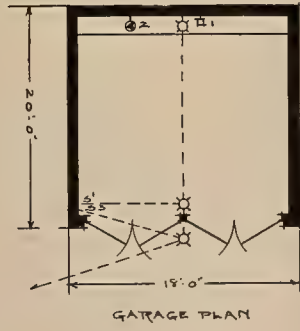
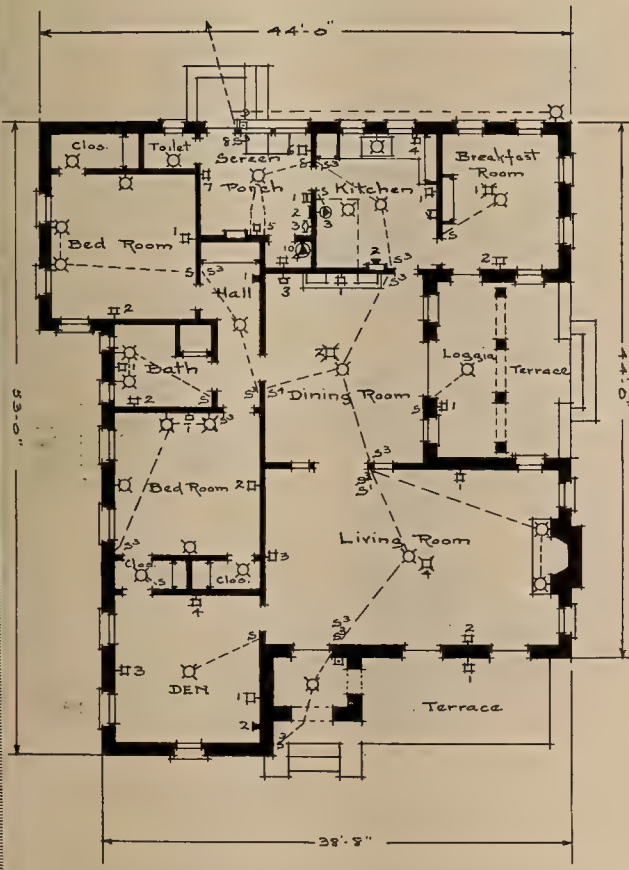
Switch



• FIRST FLOOR PLAN •



• SECOND FLOOR PLAN •



FLOOR PLANS OF ELECTRICAL HOMES

The two plans above show the wiring arrangements of Sacramento's electrical home, indicating the location, for both first and second floors, of outlets, ceiling lights, wall brackets and switches. The lower plans show the very complete outlet arrangements in the new Los Angeles home (E. B. Rust, architect), and its garage. There are

four outlets in the living room and four in the den, to accommodate lamps, vacuum cleaner, phonograph, etc. The dining room has three outlets, the loggia terrace one, for a sewing machine, for instance, and the breakfast room, bedrooms and bathroom two each. On the screen porch are located the meter (1), the power and light distributing panels (2), outlets for the refrigerator (4), flatiron (5), washing machine (6), ironing machine (7), water heater (10), and a three-way switch (8) for yard and garage lights. The kitchen has outlets for dish washer (1), range (3) and utility motor or fan (4). The garage is furnished with an outlet for an extension light, and another for an air pump, battery charger, etc. This home will be opened for inspection about October 1st.

At Home In the Electrical Home

Convenience and Beauty Mark the Electrical Installations at the San Francisco and Oakland Electrical Homes



The bedrooms were wired with convenient base outlets for electric heaters, portable lamps, bed warming pads, and such comforts. In addition the dressing table was provided with a multiplex receptacle to make easy the use of the various electrical accessories to the toilet.



The Electrical Home interior should be planned with the greatest care to bring out the possibilities of convenience and beauty which a complete electrical installation can mean to the housewife. The views here shown of the arrangement of furniture and appliances in the San Francisco home in the St. Francis Wood show what advantage can be taken of the many opportunities which such an experiment offers. The house was completely outfitted from top to bottom with special forethought, even to such details as the placing of the meters and the installation of a fool-proof and intelligible fuse and switch panel.



The master switch at the bedside of the main bedroom was a feature which called forth especial interest from visitors. This switch is so arranged that at any sign of suspicious disturbance below, one light can be lit in every room, as well as lights in the rear of the house which cut off the avenue of escape.



The parlor was provided with portable lamps at strategic points, for all of which convenience outlets were provided close at hand. An electric log in the fireplace, an electric phonograph, indirect and wall bracket lighting and a baseboard receptacle for the use of the vacuum cleaner completed the electrical equipment.



The laundry was one of the most attractive departments of the house, with a complete outfit of washing machine, fan, mangle and iron. These were located in a sunny room just back of the kitchen which would ordinarily have been given up to the servant whose place in the home is now filled by electrical conveniences.

HOW ELECTRICITY ELIMINATES THE LABORIOUS FEATURES OF COOKERY



The kitchen is usually associated with strenuous hours spent over a hot stove, superintending cookery which has to be watched every moment, but the automatic electric range allows the housewife to do other things while the roast looks after itself. This kitchen was also wired for an electric fan, iron, etc., and had an electric water heater installed.



A feature of the breakfast room was a multiplex receptacle, attached under the table, which permits of several appliances being operated at the same time without trailing cords from distant baseboard outlets. A complete breakfast can be cooked and served sizzling hot without anyone getting up from the table.

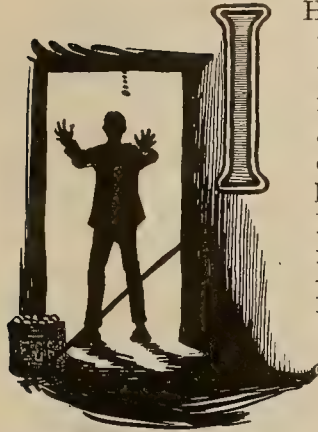


On August 15th, under the auspices of W. H. Leimert Company, the third model Electrical Home opens its doors to the public for inspection. It is located in the Lake Shore district in Oakland, and will be introduced by an extensive publicity campaign similar to that worked out for the St. Francis Wood home on the other side of the bay.

A Woman's Convenience

BY A WOMAN

(From the architect, the contractor and the electrical industry en masse we have heard extended accounts of what the electrical home is. We now have the opportunity of hearing what it should be, from the final authority on the whole subject—the Woman Herself.—The Editor.)



Practice makes perfect. But why not have the switch at the door and conserve your profane vocabulary for more artistic occasions?

HAVE been waiting for the time to come when there will be no more bargains in real estate on the market—and we may build a house of our own. For all my housekeeping career I have lived about in houses I did not plan, houses that were picked up at a bargain and that we lived in until a new purchaser should turn up who in turn would buy from us at a bargain—but at a bargain, be it said, somewhat higher in figure than the one we were party to some few months earlier in the season. I have lived in houses with views and houses without, houses with a garage and no servant's room and houses with a chicken house but no garage, houses with baseboard outlets all over the place and houses whose electrical facilities consisted of a remodeled gas jet in the center of each room—but of all the houses in which I have ever lived, not one was designed by a woman. You could tell it by the arrangements made for keeping brooms, you could tell it by the drainboards of the sink, but most of all, I think you could tell it by the lack of housekeeping knowledge displayed in the wiring of the house.

When I build my house, it is going to be completely wired to take care of any electrical appliance I may later want to put into it. I know it will be expensive, but I have found to my sorrow before this that it costs money, even more money, to have re-wiring done after your house is all finished. I doubt if I could afford an electric range at the present time and besides, I notice the electric company isn't urging me to install one, but some day I am going to want one and I want to be able to install it without tearing out sections of the plaster and wall paper and then discovering that the wire which serves the whole house isn't big enough.

Catastrophes in Dark Corners

I am going to have electricity all over the house and what is more, I am going to have it in the places where I want it. I don't know why it is that a man who will have sense enough to put in an indirect lighting system, combined with outlets for table lamps in the parlor, will forget that cool-cupboards are occasionally used after dark and leave you to put your hand into the apple sauce when reaching for the cold meat; but it has been done, as I know to my sorrow. I want a light by the ice box, too. I am

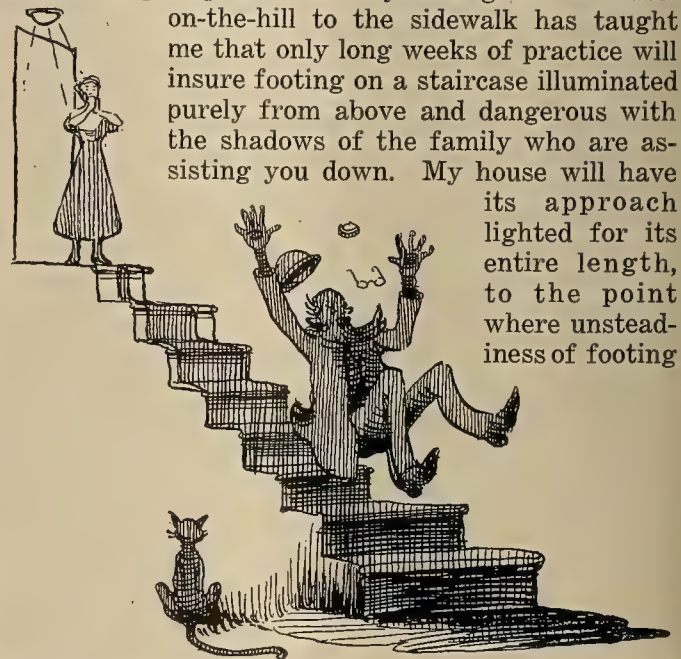
quite aware that ice boxes are not usually in place at the time that the wiring is put in, but it is a safe chance to take it for granted that there is going to be one eventually—and luxurious indeed is the house which has more than one available place for standing it.

Lights in the closets are not uncommon and I approve of them, particularly in the coat closet where family rubbers are to be sorted out on a rainy day and where umbrellas lurk in corners to descend upon the head bent in search of the hat which has slipped from the hook.

I have several other locations selected in which I shall arrange for lights. One is the stove, which will have the light so placed that it falls from one side and does not throw my own shadow on the frying pan where I am trying to see if the chops are done. There will be a light in the back of the house which will throw sufficient light into the back yard so that when I forget to take in the fur coat which is being aired for the moths, I will not necessarily fall over the blackberry bush and catch my chin on the clothesline. There will be a light in the coal cellar, too—where, incidentally, I always keep the logs for evening fires and which, in consequence, is visited in the evening, and there will be some means of lighting the jelly closet which does not necessitate groping across a floor cluttered up with jars of preserved eggs and garden tools to find a switch. A precipitous stairway leading from a house-

on-the-hill to the sidewalk has taught me that only long weeks of practice will insure footing on a staircase illuminated purely from above and dangerous with the shadows of the family who are assisting you down. My house will have

its approach lighted for its entire length, to the point where unsteadiness of footing



This guest was not kicked, he fell;—evidently an everyday occurrence on these badly illuminated steps, judging by the supreme unconcern of the cat.

becomes the responsibility of the city light department and the prohibition officer.

Illuminating a House Tactfully

House-numbers as a rule are meant to be seen. There are occasions, familiar through much reading of funny papers, when the house-owner is presumed to be hiding from the bill collector and the piano agent, but even a number painted the color of the



This is simple, but wait until you have the piano here instead of the sideboard

house and overgrown with vines has not proved an insurmountable obstacle to such as sought with a purpose. Uncle Henry, who is to leave the young hopeful of the family thousands, on the other hand, has been quite annoyed at having to ring the neighbor's bell to inquire our whereabouts. My street number will be illuminated with a special light, all to itself.

Every hallway is to be lightable from the floor above and below it, as well as at a convenient point in its own vicinity. Bathroom lights will be located on either side of the mirror, bedrooms will have wall brackets rather than center fixtures, so arranged that there can be light enough at the bureau of the guest room for the visiting ladies to criticize their hair without having a blaze of light in the center of the room which will show up all the worn spots in the bedroom rug and rob the simple room of any charm it may possess. Oh, yes, and I shall also have sufficient lights in the parlor, so that wherever the idiosyncracies of my furniture determine that the phonograph must stand, it will have a light in its vicinity.

Convenient Convenience Outlets

This house of mine will have plenty of convenience outlets, so placed that they will be a convenience. This means that they will not be located in the baseboard of the parlor in the center of the only blank wall which gives space enough for the piano, so that you must either remove the piano when vacuum cleaning, or use a lamp socket. We used the lamp socket. I have been known to crawl under the sideboard when necessity demanded that the dining room be cleaned—but in my new home, the outlet will be located in one of the odd lengths of wall space uninviting for the larger articles of furniture and will, preferably, be located somewhat above the baseboard in an inconspicuous spot.

There are other things. I am going to have an outlet in my dining room floor for the dining room bell, but it will be flush with the hardwood, so that it will be possible to dance over it. For the same

occasions and for obvious reasons, the fixture over my dining room table will be sufficiently flexible in its supports so that it can be hoisted above the forehead height of innocent visitors, for whose murder I have no desire to be responsible. And the electric iron: I am of simple tastes and open to reason, but I shall not be satisfied unless there are connections available for this useful implement in every room in which I am apt to want to use it—sewing, washing, or pressing clothes—and the cord is not connected overhead! Try dodging the cord when ironing from a middle-of-the-room fixture once and be convinced.

I am taking it for granted, you see, that all these

When trying to locate a blown fuse it is a good plan to use a strong 6-ft. stepladder and conscript the entire family to hold it. A still better plan, however, is to have the fuses located within reach, as this type of indoor sport is not an ideal form of entertainment at an evening party.



electrical conveniences can use the same connections and can be moved to all parts of the house. In the past I have found this not always so, but my house will insist on uniformity.

Wading Round the Dishwasher

I want a dish washing machine, but I want to be told what to do when using it in a city where the water is slightly hard and in consequence little rings form upon the dishes when they dry. Is there a solution which can be used without injury instead of soap, so that the water is softened? As for both this convenience and the electric clothes washing machine, which I already have, I shall be most particular about their being connected to an outlet pipe. One of the great problems about the electric washer, one that is a real inconvenience and spoils much of my pleasure in it, is that I must either drain it off into a bucket, which must be emptied at minute intervals, or I must let splatter all over the laundry floor in finding its way to the floor drain. If I am to have electrical convenience, the plumbing attached to it must be right. It is as much a part of the electrical installation—and I should think would be one of the concerns of the electrical contractor—to see that the space allowed for the washing machine provides a possible means of emptying it of water without a bucket, as to see that the outlet is provided. I presume the contractor is interested in selling the washing machine afterwards. Similarly, the matter of

12. Be sure that the porch has a porch light that does its duty, that is one that lights the porch.

13. Be sure to have a switch controlling the lights of each room near the door. A snap switch at the fixture may be all right for certain types of fixtures, but some day the owner may want to put in indirect lighting.

14. Be sure to keep the circuits below capacity. In case the owner decides to add more lights there will be capacity enough in the circuit to add them on without having to put in an entirely new circuit.

15. Be sure that there is a light over the kitchen sink and the housewife will call you blessed.

16. Be sure and place a door switch on the closet doors.

17. Be sure that when there are two doors to a room there is a switch by each door so that the lights in the room may be put out or on by a person entering either door.

18. Be sure and advise the owner of the house as to the proper type of fixture to be installed so that he will have the maximum of efficiency from them.

19. Be sure and place at least one duplex receptacle in each room. The increase in cost is very slight, and it will provide for some use of current in that room which may have been entirely overlooked when the house was designed.

20. Be sure to consider the bathroom—a bracket light on each side of the mirror for the man of the house when he is shaving, an outlet for a shaving cup, and a baseboard receptacle for an electric heater. Also be sure that all sockets are of porcelain and that the wall switch is in a grounded switch box. Remember that more accidents occur in the bath room than in any other room in the house. "Safety First."

21. Be sure that you are right, then go ahead. Remember that every house you wire bears your trademark and that a mistake on your part will be remembered when all of the good work you have done is forgotten.

PERMANENT ELECTRICAL HOME DISPLAY

Another important step in cooperative publicity has been taken by the electrical dealers in Los Angeles with the installation of a display in the Permanent Exhibit of Household Economics inaugurated by the Evening Express.

The third floor of the Express Building has been converted into an auditorium where daily lectures and demonstrations are given on the subject of better housekeeping. The wall space about the lecture room is devoted to permanent exhibits and one large section has been taken by the electrical men.

This section is divided into four booths, attractively arranged for the exhibition and demonstration of electrical devices suitable for the modern home. These booths are in charge of a paid demonstrator who is in constant attendance from nine to five daily.

The exhibit is proving particularly successful on account of its unique appeal to housekeepers. The plan is to arrange dates ahead with various clubs, inviting their entire organization to meet in this auditorium on the day specified. Mrs. Kate Vaughan, who has charge of the exhibit, arranges special programs and also serves lunch to the visitors. In this way the highest type of prospect is brought in touch with the exhibit and the program offered fits very nicely into their seasonal scheme. After the program the visitors quite naturally drift to the demonstration of the electrical appliances and a high percentage of live prospects is secured, over 200 being obtained during the first month of the exhibit.

Sometimes sales are made on the floor, the articles being secured from the various dealers in rotation. Prospects are secured and turned over to the contributing dealers to canvass. The usual methods of advertising by distributing circulars and follow-up letters are pursued. To date the average daily attendance at the lectures has been in excess of 200.

The dealers under whose auspices the electric demonstration is conducted are: Wilson's Electric Shop, A. S. Tyler, Foulke's Electric Shop, F. E. Newberry Company, and Electric Lighting & Supply Company.



Joint Exhibit of the Electrical Dealers of Los Angeles which is being given in connection with the Permanent Exhibit of Household Economics in the Express Building



There is no form of educational publicity which can familiarize women with the possibilities of electricity in quite the same way as can the use of it in the daily duties in the home. In this Practice House where students live and work as though in their own homes, the method electrical is employed in every possible branch of housekeeping.



Educating Women for the Electrical Home

BY MILLICENT L. SEARS

(Manufacturing labor-saving appliances does not make women use them, and while a certain conservatism in the human mind sometimes tends to hinder their adoption in the home, the same quality tends also to make them indispensable to women who have been trained to use them. In this connection few educational campaigns could be more effective than the type of course given this summer by Professor Millicent Sears, formerly head of the School of Home Economics of the University of Nevada and State Supervisor of Home Economics Education for Nevada.—The Editor.)

The electrical home idea is now being promoted by the universities. One of the features of the instruction in Home Economics at the University of California summer session is a course in household management which includes the use of electrical labor-saving devices as part of its regular routine.

In recognition of the fact that the efficiently managed modern home necessarily involves a familiarity with these devices, arrangements were made to secure one of the fraternity houses to be used as a demonstration or practice house during the summer months. Unfortunately the house was wired only for lighting, but by means of many two and three-way plug sockets the necessary appliances were accommodated. These, which were all lent by the Pacific States Electric Company, include an electric range, washing machine, ironer, sewing machine, ovenette and vacuum cleaner, as well as all the smaller appliances—various types of electric heater, a coffee percolator, toaster, electric iron, and so forth. The interest of the Berkeley electric firms was shown by the fact that W. E. Knowles of the Campanile Electric gave freely of his time and effort in the original placing and connection of the equipment.

Practical Housekeeping

A few students live in the house, performing all the regular duties of housekeeping, including cleaning, washing and cooking, with the aid of the labor-saving electrical appliances. In addition, large regular classes assemble in the house for practical work. Each of the half dozen students will bring a week's washing and put it through the complete laundry process with the electric washing machine, ironer and

flat iron. Meanwhile another student operates the vacuum cleaner, while still others cook light meals. Appetizing stories are told, by the way, of strawberry shortcake baked in the electric ovenette. The whole idea is to conduct a genuinely homelike establishment where the student learns to handle the actual routine of daily housekeeping in the most efficient way, and acquires a familiarity with modern methods which will be of inestimable value to her when she applies them either in her own home or in teaching.

On one occasion, as part of their required work, the entire class made an expedition to San Francisco's new electrical home, inspecting it throughout, and wrote a full account of their impressions.

Learning Repair Work

In addition to the household routine, the house management course includes special lessons and demonstrations in the simple wiring requirements of the electrical home, the connection of wires to plugs, the replacement of fuses, and minor repairs which the housewife may be called upon to handle herself. If a fuse is blown (and occasionally one is blown deliberately for demonstration purposes) it is replaced by a member of the class. The familiarity thus acquired with electrical appliances accomplishes a great work in destroying that fear or distrust of electricity which makes some women so reluctant to use it freely in the home. It is noticed that many of the students begin by being afraid to handle the appliances, but quickly overcome the fear, and learn to appreciate the increased efficiency of the method electrical.

Spreading the Electrical Home Idea

The class consists of about sixty students from all parts of the United States. They may be roughly divided into three general classes: the younger students, consisting chiefly of brides, or freshmen just entering college and preparing to "keep house" in an apartment; the more mature students, who are largely teachers from various schools and colleges, and desire to bring their knowledge up to date; a number of auditors, mainly local housewives, who, though they do not take part in the active work of the class, attend the meetings regularly for the purpose of gleaning new ideas and short cuts in household management.

The idea of the Practice House has taken root in some forty educational institutions in the United States, and though complete electrical equipment is not an integral part of all of them, or of the Home Economics departments as a whole, the natural tend-



The class in cookery works in an electrically equipped kitchen, using in addition to an electric range, the electric ovenette shown in the foreground, and various other small appliances.

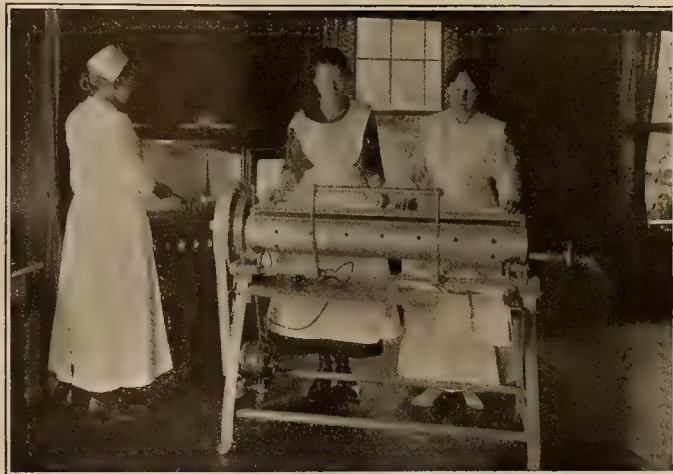
ency is of necessity in that direction. The University of Nevada, for instance, has just installed a large electric range in its new \$80,000 Home Economics building, and another is being installed in a small but progressive high school.

The introduction of electrical apparatus into these departments, with special emphasis on their use, marks a great step forward in the promotion of better equipment for the home. The bride and the young student just starting housekeeping will come to consider labor-saving devices as indispensable to the properly conducted establishment; the teachers who use them will introduce them among their own students, and thus spread the idea in new and ever-widening communities; and the experienced housewife watching the appliance in use, acquires a new viewpoint which will influence her household buying in the future.

Special Significance for the West

In the West, where electric power is comparatively cheap, even isolated ranches up in the highlands are constant users of electricity, especially when they are located near streams. On many of these ranches we now find modern electrical devices even in the home, replacing the labor of the farmer's

wife. Children from such ranches, when they get ready for high school, expect the electric washer and the electric stove in the Home Economics class room, just as children of a decade ago had to find wood



The various home-making duties are assigned to different groups of students in rotation, some doing the laundry work, with an electric washing machine, ironer and flatiron, while others clean the house or cook.

stoves in order to duplicate the home in the high school. Teachers are now realizing that if they would live up to their motto, "To prepare the girl for the kind of life she will go into," they must teach her the use of electrical devices and conveniences.

The question of education in the use of labor-saving devices is especially interesting in the West, where there is a scarcity of help and where the woman naturally welcomes any methods which will transform household drudgery into a light and smoothly-running routine.

ENGINEERS OF YESTERDAY

20. Murdock.

Do you know that the inventor of the slide-valve and the inventor of gas lighting are one and the same man?

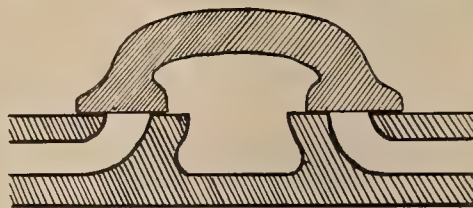


Diagram of the "D" slide valve, William Murdock's most important invention in the steam engine line.

William Murdock (1754-1839) in early life was a millwright, but the momentous turn in his affairs was in 1777, when he entered the employ of Boulton and Watt at Soho. Rising to a position of responsibility, he employed his genius in many inventions. We read of an oscillating steam engine in 1784, a steam road carriage in 1786, and later of a steam gun, experiments with compressed air and a proposed rotary engine.

The production of illuminating gas from coal was perhaps his greatest work, this being accomplished in about 1792. The first burners, because of the shape of the flames, were called "the cockspur" and "the cockscomb." They were soon followed by the familiar "batwing." His most important invention in the steam engine line was in 1799. This was the "D" slide-valve, now in such common use.



View of bungalows in the residential district of Atascadero, where the electrical home idea is making great headway. Almost all the houses are wired with convenience outlets, and use many electrical labor-saving devices.

Electrical Progress in a Model Colony

BY SIDNEY BRETHERTON, JR.

(In the agricultural community, where electric power is a necessity for irrigation and other farm purposes, the electrical home is a logical and normal development. The following story tells of the contribution made by electricity to the growth of a farm community, and indicates the progress of the electrical home idea.—The Editor.)

The Atascadero estates, forty square miles in area, are located half-way between San Francisco and Los Angeles in San Luis Obispo county. They embrace rich and fertile valleys, rolling hills and a chain of mountains on their western side.

In 1913 Mr. E. G. Lewis purchased these estates with the idea of founding a model community in which the city would be developed by and dependent upon the surrounding agricultural land; a community in which the basic idea should be cooperation.

Demand for Electricity Exceeds Supply

Atascadero and the coast regions about are furnished with power by the Midland Counties Public Service Corporation, a subsidiary of the San Joaquin Light & Power Corporation. Due to the colony's position on the end of their lines and the last three dry years, the company has not been able to keep up with the rapid growth of the section. Every effort is being made by them to cope with the situation, an article, "Electrical Development in the San Joaquin Valley," by Mr. A. G. Wishon, in the May 15th issue of the Journal of Electricity, giving a very comprehensive idea of what they are doing in the way of hydroelectric development.

Electricity has played an important part in the development of this colony. All the buildings housing the industries are modern in every detail, and in nearly every case electricity is used as the motive power.

Development of Industries

To handle the products of the agricultural lands, the Caladero Products Company was incorporated and one of the finest dehydrating plants in America was built. In the dehydrating plant all machinery is motor-operated and so arranged that a minimum of shafts and pulleys is used, assuring the greatest possible safety to employees. The coring, washing machines and conveyors, each have a separate motor with the starting device so placed that the foreman has instant control of his machine at all times. Work is seldom if ever done at night, yet an excellent system of lighting has been installed.

The first industry to be established in Atascadero, along other than agricultural lines, was the Press, which publishes the Illustrated Review. The Rotogravure Process, used in the printing of the Illustrated Review, is essentially an electric one. When the proper material to make a page has been assembled, it is photographed by the use of large arc lights. From the negative produced here, a positive film is made with the help of a mercury light. This film is then placed on a copper cylinder, previously electro plated, and the photographs etched in with acid. These cylinders are then placed in the large rotogravure press and the page printed. The newest addition to the electrical equipment of the press is a large melting pot for linotype metal.

One of the newest firms, the Radio Photo Equipment Company, is building an electric machine for printing post and business cards at the rate of 600 per minute. This requires an extreme intensity of light focused on a small area to produce instantaneous action on the sensitized paper. They are now working on an addition to this machine that will eliminate the slowness in drying the cards after they come from the developer and are washed.



The electrically operated washing machine in the dehydrating plant

Here was one instance of where the contractor-dealer, with the aid of the jobber and manufacturer, was able to help in the solution of a light and heat problem.

New Building Activities

The Mercantile building, which houses all the stores of the colony, is now so filled that the original lighting and power circuits became inadequate. This necessitated running circuits to the new departments, and as a central point of distribution had never been planned, it was necessary to install a switch and meter board, controlling all the circuits.

The newest building is the hospital, opened on August first. It is fully equipped with electrical

model chicken ranches have been placed. Their equipment has been handicapped, as they have been forced to use the kerosene incubators and brooders. Lack of power is also holding back the installation of modern machinery for alfalfa cutting on some of the general ranches.

Electrical Homes

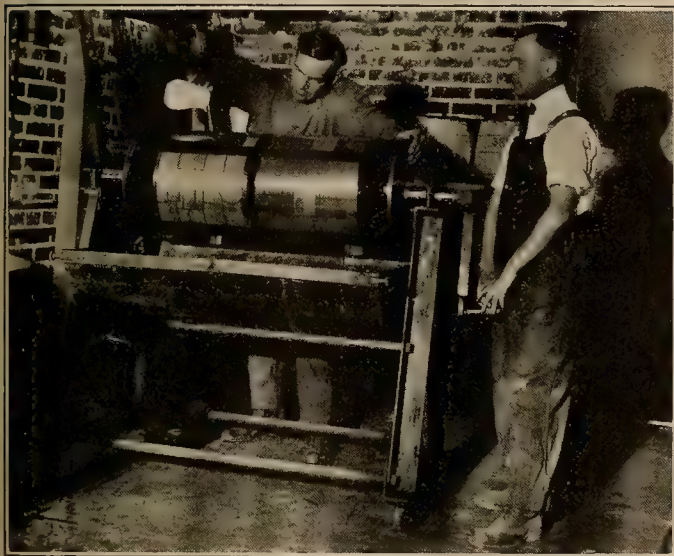
Though the majority of homes here are small bungalows of five and six rooms, nearly all have been wired with a sufficient number of light and convenience outlets. This is the result of an educational campaign carried on with the help of J. Roth, the architect, and the general contractors, making the owners realize that proper wiring is a good investment and a necessity rather than a luxury. In each case that additions have been made to the original wiring plan, the advertising value resulting from the satisfaction of the owner with his home when completed has more than repaid any time and effort expended.

At present there is under construction a house that will rival the Electrical Home in St. Francis Wood in San Francisco. In addition to the proper outlets and switches there is to be a vacuum pump in the basement with hose and switch connections at several points in the house. An electric refrigerating plant is to be installed, and the house is to be equipped with all the latest household electrical appliances.

This colony has no gas service or coal for fuel, and wood is extremely expensive. As a result most people use kerosene for cooking but are having their houses wired for range service, awaiting the time when the power company can take on this load.

Local Service

Through the solution of small electrical problems, the people of Atascadero have come to realize that the place to receive electrical service is at their local dealer's, and in the solution of the larger problems the hearty cooperation of the jobbers and manufacturers has always been forthcoming. This cooperation has built up a real electric service, which has been and will continue to be an important factor in the development of the community.



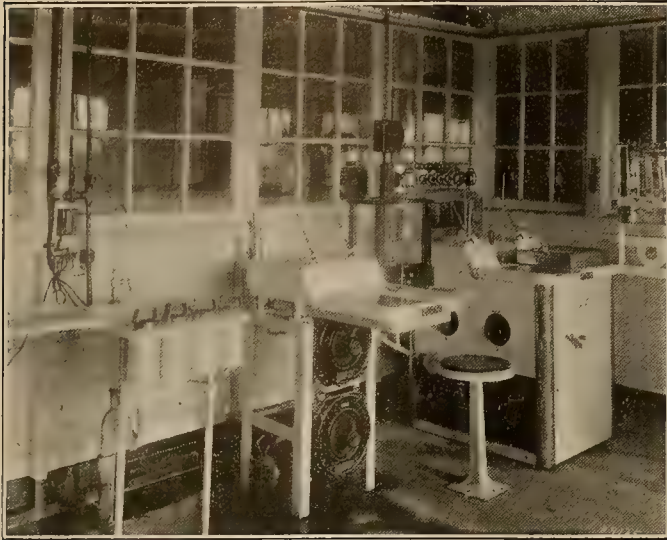
Etching copper cylinder, Atascadero Press. The newspaper industry was among the earliest in the community to use electric processes.

devices, and the battery of six sterilizers, the hot water system, the dumb waiter and the laundry are all electrically operated. Convenience outlets have been placed in every room for heat and light besides the usual call and telephone connections.

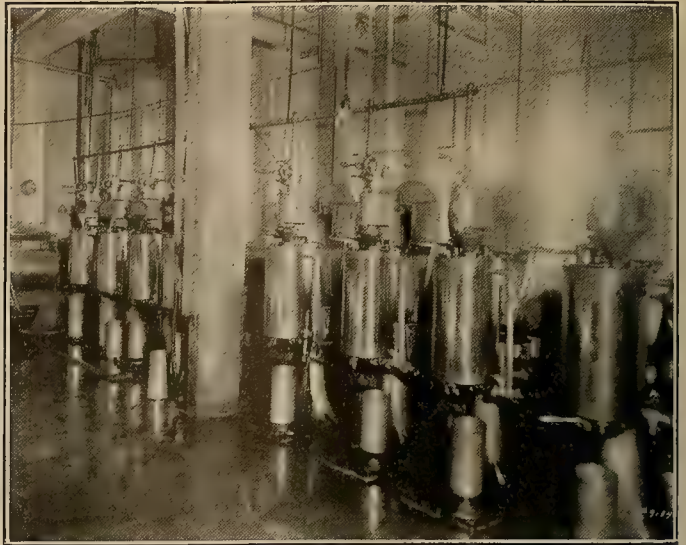
It is in the agricultural districts that the shortage of power is felt. People whose land needs irrigating are waiting for available power to install motors and pumps. It is in this district that the

The upper picture shows a fine grove of four-year-old trees, and the lower shows last year's bumper peach crop from them. The agricultural activities of the community demand for irrigation far more electric power than is obtainable at present, though new hydroelectric developments will soon relieve the shortage.





The laboratory at the Benham Ice Cream Company's plant. Here the cream is tested for butter fat content and brought up to standard.



The 40-gallon-per-hour ice cream freezer where the mixture goes through its final process before passing to the hardening room.

Making Ice Cream Electrically

(Keeping a community cool in summer is a task demanding as much electricity as that of keeping it warm in winter. The following interesting description of ice-cream making is typical of the extent to which manufacturing plants of all types are coming to depend upon electric power.—The Editor.)

Among the industries in the San Joaquin Valley for which a large amount of electric energy is used is the manufacture of ice cream, water ices and sherbets. One of the largest manufacturing concerns of this character in the West is located at Fresno—the Benham Ice Cream Company, which was established on a small scale in 1906, and this year will have an output amounting to about 650,000 gallons. Of this amount, approximately 250,000 gallons will be distributed in, and immediately adjacent to, the city of Fresno, through nearly every confectioner's store, grocery store, drug store, etc. The balance is shipped to all the towns and suburban stores throughout the San Joaquin Valley and in the mountains to the east, so that a person may travel anywhere throughout this section of the state, whether it may be away out in the oil fields or the west side grain fields, or high up in the Sierras, and procure a dish of "Benham's Ice Cream," "made electrically."

Employing Five Thousand Cows

During the summer the plant is run on a twenty-four hour basis, and 4500 gallons of cream is used per day, representing the output of 5000 cows. The peak load for this summer is expected to be 6000 gallons of ice cream, water ices, etc.

The surplus cream during the winter months is condensed and used later to bring the butter fat value of the "mixtures" up to the required percentage by mixing with the fresh cream as required. Part of the surplus is sold for the manufacture of butter and cheese; and it might be interesting to note that the peak load of the ice cream factory is in the summer time and the peak load of the cheese manufacture is in the winter.

It is reported that a half-million pounds of sugar is required by this plant this year in the manufac-

ture of ice cream, ices and sherbets, and 500 tons of salt. In order to pack the product for delivery on the peak load day, sixty tons of ice is required, and this is manufactured within the plant. The daily "refrigerating capacity" of the plant is eighty tons.

How Ice Cream Is Made

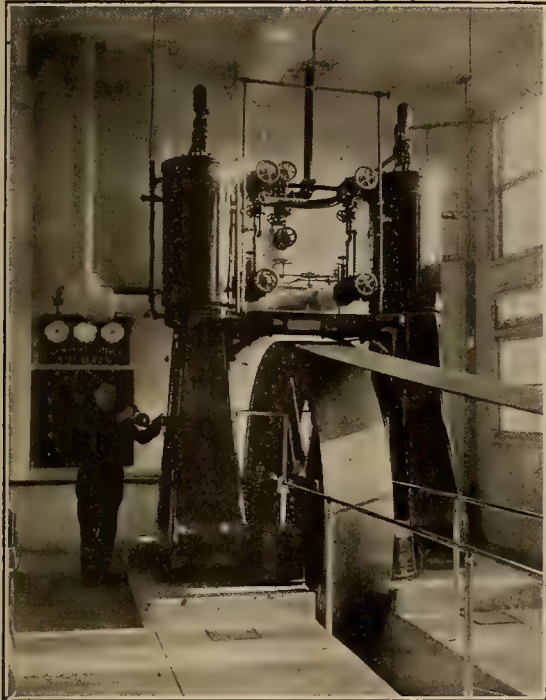
The cream, as it arrives from the San Joaquin Valley Milk Producers' Association creameries, is first tested, samples being taken from each batch and a record kept of the butterfat content, and sufficient cream, condensed during the dull season, is added to bring the test to standard. For the purpose of these tests a very elaborate laboratory containing equipment costing over \$3,000 is maintained. The enriched cream then goes to a large mixer on the third floor, where sugar and other ingredients are added, and the "mix" is pasteurized. The mix is then drawn into a homogenizer in which the fat globules of the cream are broken up, making the mixture smooth and velvety, after which it is drawn off into large glass-enameled holding vats of 5500-gallon capacity each, in which it is held for twelve hours undergoing the process of ageing and ripening in order to prepare it properly for freezing into cream of uniform texture and quality. This process is all on the second floor.

The mixture is then drawn into the freezers on the first floor. There are four 100-gallon-per-hour freezers, each equipped with a 7½-hp. motor, and twelve having a capacity of 40 gallons per hour each, driven by 2-hp. motors. These freezing machines are not such as most of us would picture; they are not built on the principle of a can which revolves in ice, but consist of a stationary cylinder, silver lined, surrounded by an air-tight space in which is coiled, close against the side of the cylinder, rectangular-

shaped copper pipes through which the brine is circulated sixteen times around the cylinder at a temperature of 0° F. while the mixture within the cylinder is agitated by two sets of paddles which rotate with two different motions similar to the paddles in the common home freezer.

The flavoring is added to this mixture as it is drawn into the freezers—a specific amount being added to each freezer batch.

The cream is not frozen hard in these freezers, but is drawn off at a pasty consistency into the cans or molds, and passed immediately into the hardening room where it hardens and ages. This hardening room is kept at a required temperature of 10° or more below zero, F. by means of a current of air blown against ammonia expansion pipes, and in here



One of the ammonia compressors where the ammonia, expanding, extracts heat from the brine used as a refrigerant.

the cans and molds are left for four hours before they are ready to be sent out for distribution.

Ices are prepared in the mixers on the third floor and drawn from there direct into the freezers; also frozen puddings. The punches are prepared, as a rule, by hand.

Special Equipment

Containers are thoroughly cleansed and sterilized of course before being filled, special machinery being used for this purpose. Centrifugal brushes, through which streams of boiling hot water are sprayed, scour the cans, after which the cans are placed in sterilizing machines where they remain in boiling water for one minute; they are then placed on a rack where they dry almost immediately, on their way to the freezing room.

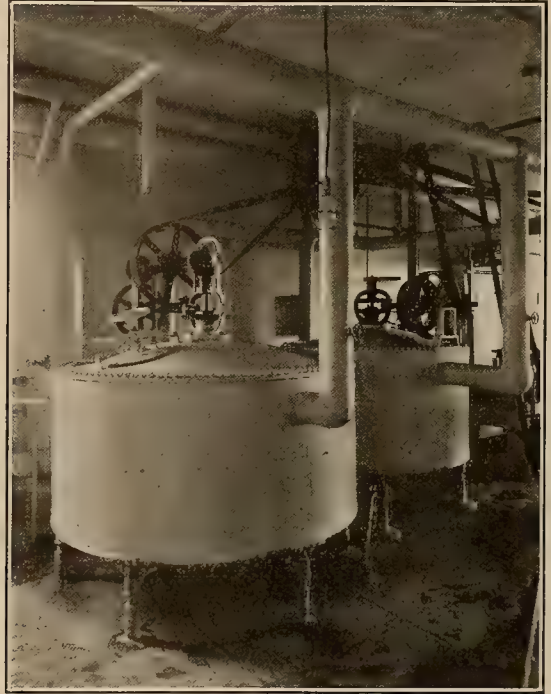
The company operates specially built trucks for distributing the product in and around Fresno, there being twenty of these vehicles in all, part of which are Walkers and part are General Vehicle Electrics, having a capacity of 300 gallons of ice cream and two

tons of ice and salt. Some of these trucks are nothing less than refrigerating rooms on wheels, having brine circulating pipes so that the compartments, in which the ice cream is stored for delivery, are kept cool.

The company operates its own charging outfit, using a motor generator set for the purpose.

The company does not deliver beyond the immediate vicinity of the city of Fresno with its own trucks, but delivers to the auto stage lines and express service systems through a very comprehensive schedule under which dispatching is carried on practically throughout the entire twenty-four hours; in fact, most of the orders come in from the Valley points at night.

All the ice and salt required for packing is de-



Tanks where the ice cream mixture is made, and held over to ripen. It is frozen to its final state in a special freezing room.

livered with the product, the ice itself being manufactured in this same plant and crushed by two crushers having a capacity of twenty tons per hour. The concern also distributes cones on a jobbing basis, distributing 2,000,000 of these last year.

Besides the fifteen employees required in the office and order rooms, as many as ninety-five employees are required in the factory during the summer.

The plant contains a 50-hp. steam boiler for sterilizing and heating purposes, and for condensing the milk surplus. Water is pumped from private wells for all uses in the plant. The principal compressor is driven by a 75-hp. motor, and there are two small ones driven by 25-hp. motors. There are 34 motors in all, with a total capacity of 226 hp., and the maximum 15-minute demand to date is 181 hp. One of the most novel features is the last electric truck which has been equipped with a complete refrigerating plant. This truck has two product compartments and is equipped with an electrically-driven system instead of refrigerating with salt and ice.

The use of electricity in the ice cream plant facilitates a process which is very exacting, and which is subject to very heavy demands during the rush season, and requires great flexibility. On account of the requirements for complete sanitation individual electric drive is considered the only satisfactory method, and the owners and operators of this plant find absolutely no inconvenience, in fact, they never have to think of their driving apparatus and are free to give all their attention to the manufacture and delivery of a product in which uniformity and reliability are particularly to be desired.

The plant represents an investment of over a quarter of a million dollars, and it is said that it is the most complete and largest of its kind west of Chicago, not even excepting San Francisco and Los Angeles factories.

RAISING CHICKENS ELECTRICALLY

BY M. S. BARNES

(Labor-saving devices on the farm are among the most important contributions which electricity has made to rural progress. Following is an account of a plant which eliminates practically all human labor, and accomplishes efficiently a task which formerly could only be undertaken on a much smaller scale and with infinite trouble.—The Editor.)

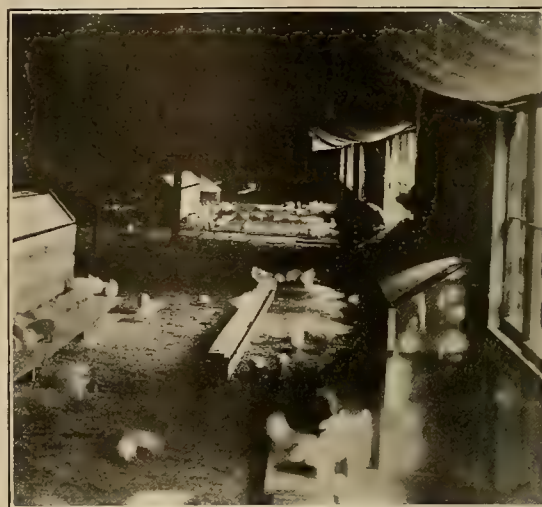
A chicken-brooding plant said to be one of the largest, most modern and scientific in the world, has been built by J. W. Dobbins of Sebastopol, California. It is so scientifically and conveniently arranged that the services of only one man are required to raise and handle thousands of chickens. The electrical features of these modern chicken brooders have contributed so much to their success that a new field has been opened up for further practical application of electrical appliances. This installation should prove very interesting to power companies as well as to manufacturers and electrical contractors, because the large number of Mazda lamps together with the heaters and motors make up a combined load which is well worth while. This load extends over a period of approximately nine months, beginning the latter part of September and extending into June.

At the present time Mr. Dobbins has four brooder houses. One is 20 x 130 feet and is equipped with a 16 x 20-ft. four compartment brooder for taking care of 4,000 chickens. The other three houses are 20 x 100 and have 9 x 16-ft. single compartment brooders, each capable of handling 1,500 chickens.

The brooders are the acme of perfection, and are designed and built entirely on new principles. The usual principle of brooders is to set the unit of heat at a central point and place the chickens about it, or to set it in a long line brooder and have the chickens run in or out on one side. These principles, according to Mr. Dobbins, are unscientific in that they do not radiate the heat so as to cover all the chickens at one time with an even and uniform temperature. The new principle which he has worked out reverses this old method, and instead of placing the chickens around a central heating unit it completely surrounds the chickens with the heat.

All the brooders in the three smaller houses are similar. They are constructed in a rectangular

form 9 feet wide by 16 feet long with a well hole of 5 x 12 feet in the center. This well is surrounded with a double coil of one-inch hot water circulating pipes placed under a board covering two feet wide all around it. Around the outside of the brooder is a six-inch fringed billiard cloth. The well has a cover which can be raised or lowered. It is equipped with a ventilator in the apex or center controlled by



Drinking fountain, window blinds, feeders and so forth are all automatic in this new electrically equipped chicken brooder, and only one man's labor is necessary in the raising and handling of thousands of chicks.

a thermostat. When the chicks are put in at the start they are kept in the well space during the entire first day. The next day they are allowed a three-foot space all around the brooder. This space is enlarged day by day as they grow older. The feeding during the first two days is done in the well. The brooder in the larger house is of the same design except that it is larger and subdivided. Each of the four brooders has an independent hot water circulating system, heated by the latest 2-kw. electrical heaters which have been developed by the Edison Electric Appliance Company. They are all equipped with thermostats which maintain a remarkable evenness of temperature in the brooders.

Putting the chicks to bed at night has always been a problem, but this difficulty has been overcome in a very novel and simple manner. Lights have been placed around the inside of each brooder well. When the time comes to put the chicks to bed the attendant simply turns off all lights except those in the brooder. Since chicks do not like to be running around in the dark they immediately flock into the brooder where the light is and in a few minutes the lights can be turned out and all the chickens will be in the brooder. Each of the buildings is thoroughly lighted so that the houses can be brilliantly illuminated in the morning and late afternoon in order that the chicks can be kept busy 15 hours a day. There are 115 40-watt lights in the four buildings.

The drinking water is supplied by new principle fountains. They are designed to furnish fresh running water constantly and at the same time are automatically self-cleaning. Each fountain is equipped with electric lights for night use. The lights illumine the rippling surface of the water and the chicks

will drink where otherwise they would not. Other conveniences such as blinds for the windows, automatic feeders, and so forth, are all worked out so that the routine involves a minimum amount of time and labor.

The water supply is taken care of by a 5-hp. motor controlled by a float switch. This automatically furnishes an abundance of water at all times. Another motor is used for the feed cutter. Vacuum cleaners are used to pick up all straw, dust and dry droppings. Each house is supplied with a stationary motor-driven spraying pump and whitewashing apparatus equipped with a sufficient length of hose to reach every crevice both inside and outside the building.

The electric control of the whole plant is most thorough and complete. All human agencies are eliminated wherever possible. An electric bell system is so arranged that an alarm is sounded if the heat or lighting fails at any time.

Offhand, one might think that this would be a very expensive system to operate, but such is not the case. During the worst month of the year with a new batch of young chickens, the cost for current will not exceed \$120.00. Any other system would require more help in addition to the maintenance of some other class of heating and lighting.

The plant has shown a remarkable record for percentage of chickens raised. It has been so satisfactory that the owner is now planning on another larger and more elaborate building.

The electrical equipment and the circulating water system were furnished and installed by the J. L. Bone Company of Sebastopol. Due to the showing of this plant Mr. Bone expects others to fall in line.

ELECTRICITY IN A MODERN HOTEL APARTMENT HOUSE

(Newly erected buildings in up-to-date cities are becoming more and more notable for their electrical equipment. A thoroughgoing example of this evidence of progress is afforded by the new hotel apartment house described below.—The Editor.)

The installation of electric ranges exclusively in the new Belvedere Hotel Apartments in Salt Lake City is part of a consistent managerial policy by which the highest possible class of service in every department is rendered to the patrons of the establishment.

This is the first hotel apartment erected in Salt Lake City, and will have one of the largest, if not the largest single installation of electric ranges in any one building in the United States.

The building contains 147 apartments in each of which is installed a beautiful Westinghouse 2-19 B semi-automatic electric range with white enamel door and splasher to harmonize with the white enamel finish of the entire kitchen.

The exterior of the building is of red tapestry brick trimmed with polychrome terra cotta and a gray granite base. The lobby walls are of Caen stone, black and gold, marble base, black and white marble floors, elevator doors glazed with small panels of crystal mirrors, beautiful candelabra lighting fix-

tures finished in polychrome and gold with silk shades, giving the lobby the quiet elegance of a palatial home.

Opening directly off the lobby is a beautifully appointed lounge and ballroom in which special atten-



At the left is a partial view of the new electrically equipped apartment house in Salt Lake City. The right hand picture shows one of the modern electric ranges installed in each apartment.

tion has been given to artistic lighting. A billiard room has also been provided for patrons at a cost of approximately \$100,000.

The lighting fixtures for all apartments are specially designed candelabra chandeliers of various characters, some finished in silver and others in polychrome and gold.

The building is steam heated from a central heating plant in the rear and is also equipped with a refrigerating and filtering system, electrically operated.

The apartment will require approximately 30 kilowatts for lighting, 100 kilowatts for fuel and 45 horsepower for elevator and miscellaneous power operations.

Miller, Wooley & Evans of Salt Lake City were the architects and the building was erected by Vil-ladsen Brothers, Inc., general contractors. The building is the property of the Mormon Church, but is leased and operated by the Ensign Investment Company of which Dr. J. T. Keith of Salt Lake City is president.

The formal opening of the apartment will occur November 1.

SWISS MARKET FOR ELECTRIC WASHING MACHINES

With the ever increasing supply of electrical energy furnished by the development of Switzerland's vast resources in water power, consideration of various electrically driven household appliances is growing from year to year. Up to the present time the use of washing machines in Switzerland has been very limited, and electrically driven machines have been utilized only in public laundries. A local manufacturer of sanitary appliances who has branches established in Paris and Antwerp is interested in American electric washing machines, and is disposed to undertake the representation, being of the opinion that now is the proper time to introduce these appliances into Swiss households.

Manufacturing Fun

(In the amusement park as in no other place, electricity reigns supreme as the official joy-maker. The story of its work in this capacity at Idora Park, Oakland, California, is told here in some detail, showing that every nook and corner of the park must employ some sort of an electric motor to make it a success.—The Editor.)



The older scenic railroad is shown in the background and the tower which supports the whirling airships is seen in the foreground.

IN the amusement park electricity plays a different role from the one played in the factory, in the mine or on the farm. In this one capacity it plays the role of fun-maker, and for this reason the story of the park electrician has a distinct human interest touch.

When, on a flourishing holiday afternoon, L. P. Desimone, Idora Park electrician, was asked to tell his "behind the scenes" story, he led the way to the nucleus of the park, a small green power

house. Here he explained that the power, which is furnished by the Great Western Power Company, comes from the power station at Fourth Avenue Heights in East Oakland over lines which also carry power to the factories of West Berkeley. Power enters the park at 11,000 volts. A switch at the entrance makes it possible to shut off the entire supply in case of any serious fire and arrangement for connection with a neighboring 11000-volt line makes it possible to get power from this source in case anything goes wrong along the line regularly used.

Three Star Delta, 6500-volt, three-phase, 60-cycle transformers step the power down to 220 and 110-volt current and from here it is distributed to the various buildings and concessions for lighting and power purposes. An economical and somewhat unique practice is that of taking both the 220 and 110-volt current from the same bank of transformers. The 220-volt is taken from a straight tap and then the 110-volt is taken off a 50% tap. In accordance with this arrangement, all current used in the park is rated off on a 220-volt meter, then the 110-volt current is registered on a 110-volt meter so that the amount of actual 220-volt current used is found by subtracting the reading of the 110-volt meter from that of the 220-volt meter.

Balancing the Load —

The method of distribution used in Idora Park is different from that ordinarily used in places of this sort in that the three-phase current is carried direct from the transformer to the buildings and balanced through the wiring there rather than at the power house between the various buildings. The electrician states that in this way each building is independent so that any trouble which may occur in one does not entail difficulty by unbalancing the load supplying other sections of the park. It will be seen that this method of distribution also means an economy in wiring, which is an item worth considering when fifty or more buildings and concessions are to be supplied.

Economy in Wiring —

In lighting certain small buildings and concessions which are located at a considerable distance from the power house, it is found more satisfactory in every way to supply the point only with 220-volt current, using this for lighting as well as for power purposes. In these cases the motor used in operating the concession must not be overloaded, and the current for lighting is taken off the power feeds.

The use of 220-v. current for lighting of course entails the use of lamps which are more expensive and fragile than those ordinarily used, but because of the saving in wire and because a higher rate is charged for 110 than for 220-volt current, this practice has been found a distinct economy when conditions above mentioned are true.

The Concession —

In a place where power is used at as many different points and controlled by as many different men as it is in the amusement park, it is necessary to work out some system by which the manager may know just how much power is being used monthly at



A 100-hp. motor is used to operate the "Race Thru the Clouds" shown above

each point and whether or not it is being used to the best advantage. At Idora Park a book is kept in which are drawings of every building and concession in the park. This set of diagrams includes every wire, every motor and every lamp on the grounds, so that the manager at his desk can know where every bit of power is being used.

Each concession is furnished with an individual meter and record cards are given the men in charge of the operation and lighting of each concession and building. In keeping the lighting record the man records how many lights are turned on each evening at seven o'clock, how many at eight, and so on. Under the power record, he records every time the motor is turned off and exactly how long it runs.

It is found that this practice of requiring the employes to keep a particularly detailed record tends to make them more careful with the power they use. They are not liable to do the easiest thing and turn on the lights in and around their building at six-thirty or seven o'clock when they know that an exact record of this must be kept. In fact, it is found that this practice, along with the knowledge that every record is filed in the manager's office, does much to increase the operator's interest in and his respect for his work.

Motors Used in Operating Concessions —

For the most part the motors used in operating concessions are three-phase, 220-volt, of one of the standard makes. Some of these have a twenty-year record of continuous and satisfactory service behind them.

The largest single motor on the grounds is that used in pulling the scenic railroad cars to the top of the grade from where they start their dashing "Race Thru the Clouds." This is a 100-horsepower General Electric motor of variable speed. The cost of operating this concession is forty dollars per week, so far as lighting and power are concerned. A fifty-horsepower Westinghouse motor operates the older scenic railroad, and one of the same size and make is used to run the paddle wheel used in that most fascinating affair which bears the name, "Over the Top." The paddle keeps the water in a long and winding indoor ditch moving just enough to carry swan-like boats past various war time scenes. Then by means of a cable these boats are drawn to the top of an incline from where they take the final "shoot the shoots."

One of the merry-go-rounds is run by a fifteen-horsepower Western Electric motor and the other, which bears the name of "The American Derby," is carried round by a seventy-five horsepower one of General Electric make.

The most thrilling affair on the grounds is the Airship concession, the tower of which is shown in the small illustration above. Airships suspended on long arms from this tower whirl round and round at a terrific rate, far above everything else in the park. Several motors are used in operating this concession, six of which are three-phase, 220-volt non-standard make. A fifteen-horsepower, direct current, 500-volt Fairbanks-Morse motor is also used. This is a remnant of the earlier days when a number of these motors were obtained from St. Louis. It is a long remembered and significant fact in the park's history that every one of these motors had to be rewound within a year while the standard motors which have been used are still doing good work after twenty years' service.

Purifying the Swimming Tank —

The water from the swimming tank is being continually filtered under the supervision of the State Board of Health. The water runs out of the tank and into the filter house by the force of gravity. In the filter tanks it passes through three grades of gravel and is then pumped through big pipes back into the tank. Two fifteen-horsepower motors do this work. As the water passes out of the filter house, drops of chloride gas are injected into the stream at the rate of ten to the minute. This treatment with the addition of alum renders the water free from all germs so that scientific tests show that



The scenic boat ride which is the feature of the "Over the Top" concession shown here is made possible by a large paddle-wheel operated by an electric motor. The new American Derby merry-go-round is shown in the foreground.

it is a great deal purer than drinking water. The filters are cleaned twice a day by shutting off the water from the tank and turning in water from the bottom so that all sediment is washed to the top of the filter tank and taken off.

The man in charge of this filter is required to keep a log book which tells exactly when the filters are started, how much chlorine gas and alum are used and how often the filter tanks are cleaned. The water is tested by the state authorities every day.

Early Power Supply —

When Idora Park was first built it received its entire power supply from the street car line which runs past the grounds. This unique condition was true because the park was started and is owned by the traction company and power could be furnished more cheaply and easily in this way. At this time the direct current entered the park at 500 volts. One of the annoying features of the arrangement was the occasional fifty per cent reduction of the power supply whenever a street car passed by.

Lighting the Park —

In accordance with the original direct current supply the first lamps for lighting the park were strung in series of five. The original wiring in the buildings was open knob and tube, but now this has been changed so that all buildings are equipped according to the underwriters specifications.

A tower of twelve Western Electric Davis flood lights on the top of the central building really does the practical work of illuminating the park grounds. When all other lamps in the park are turned off, it is found that these twelve 1000-watt lamps illuminate the entire park. The electrician states that twenty-four more of these flood lamps will be added to the tower next year.

An 18-inch searchlight with a seven-mile range is the crowning glory of the tower. Few searchlights have as elaborate a history as this one. It was taken from a Spanish man-of-war which was sunk by Dewey in Manila Bay and was sold to Idora Park as salvage a few years ago. Being part of the equipment of the Spanish government the searchlight was

of course manufactured in Germany. A 100-volt direct current generator and a twenty-five horsepower motor are the equipment necessary to operate this searchlight.

A most festive appearance has been given to the park by coloring the lamps which outline the buildings red, green and amber. These lamps, some of which have been in use for the past fifteen years, are eight candlepower carbon lamps, 220 volts. These are more durable and consume less current than the regular lamps and because they are used more for show than for actual illumination purposes, the park continues to use these eight candlepower carbon lamps and announces that it is always an open market for as many of them as it can secure.

Thus the story of the amusement park electrician extends from one end of the grounds to the other and into every nook and corner. Every pleasure-giving arrangement, from the most thrilling roller coaster to the delicious hot dog is made possible through the use of electricity in this, its fascinating fun-making capacity.

Mechanical Analogs in Alternating Currents

BY G. R. SHUCK

(A comparison between an electrical cycle of operations and a corresponding mechanical process frequently does much to clarify the latter. A number of analogs of this type, of which the following is the first, have been prepared by a member of the electrical engineering staff of the University of Washington, and will appear serially in these columns.—The Editor.)

Practically all electrical phenomena may be duplicated in certain mechanical mechanisms, and the operation of the latter can more easily be understood than the unseen forces at work in electrical apparatus. Some of the fundamental laws of alternating currents may by this means be more clearly shown to those who are not satisfied with the conception gained by mathematical formulæ alone.

The Condenser

In the system shown in Fig. 1, C is a cylindrical chamber divided into two equal parts, A and B, by an elastic membrane, M, such as rubber. The pipes P and P₁ through valves V and V₁ lead to two pressure tanks. The pipe P₂ containing valve V₂ connects the two sides of the chamber together, as shown in the figure. The whole system including only half the tanks is filled with some incompressible fluid without appreciable weight. The tank, T, is subjected to some pressure, say thirty pounds per square inch, and tank T₁ some lower pressure, say ten pounds per square inch, by means of some compressible gas such as air.

When valves V and V₁ are opened, a pressure of twenty pounds is exerted upon the elastic membrane M, which, under the strain of pressure, will be dis-

torted into the shape shown by the dotted line, causing a momentary flow of the fluid into B and out of A; the amount of flow depending upon the amount which the membrane M will stretch, and the amount of pressure exerted on it. Upon closing valves V and V₁ there will still exist the difference of pressure

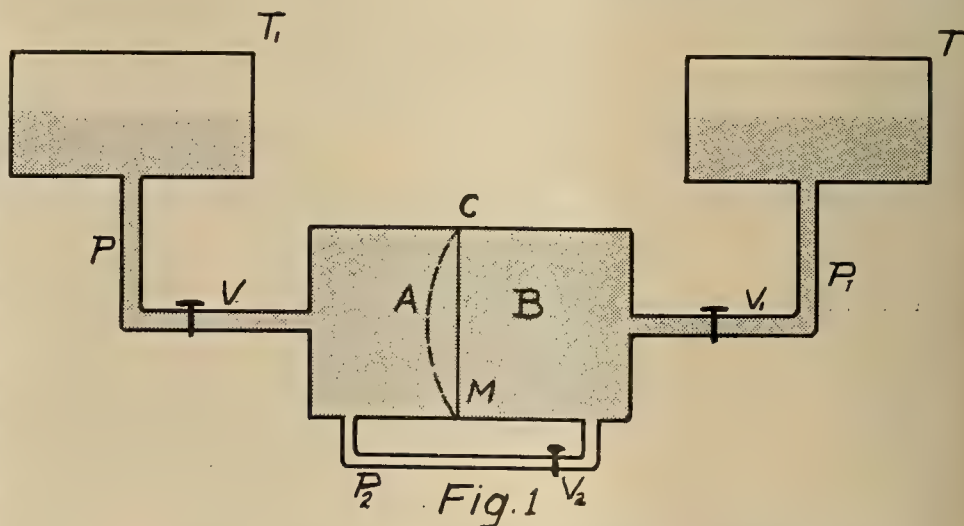


Diagram illustrating the mechanical parallel of the operation of an electrical condenser.

between the two halves of the vessel, and the membrane M will remain distorted. If the valve V is now opened there will be a flow of fluid from chamber B to A, until there is no difference of pressure between the two chambers and the membrane will return to its original unstrained position.

In the system shown in Fig. 2, A and B are two

metallic plates separated by some insulator, such as rubber, air, or paper. The conductors W and W_1 , through switches S and S_1 , lead to the terminals of a storage battery, and W_2 and W_3 connect a resistance R across the two plates through the switch S_2 as shown in the figure. When the switches S and S_1 are closed the electrical pressure of the battery is exerted between the two plates, the insulating material between the two plates receives a charge of electricity, causing a momentary flow of current through the conductors W and W_1 , the amount depending on the character of the insulating material and the electric pressure exerted upon it. Upon opening switches S and S_1 , there will still exist the difference of pressure between the two plates, and

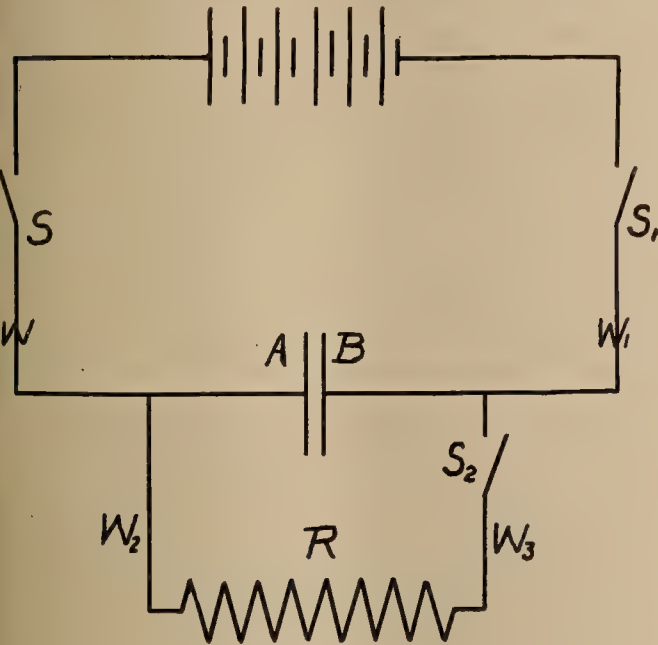


Fig. 2

Diagram illustrating the cycle of operations in a condenser

the insulating material will remain charged and under electric stress. If the switch S_2 is now closed, there will be a flow of electricity through the resistance R until there exists no difference of electrical pressure between the two plates, and no electric stress in the insulating material.

The foregoing cycle of operations shows in a general way the similarity of the two systems; the one, a mechanical mechanism following the laws of mechanics; the other, an electrical mechanism, called a condenser, following the laws of electric circuits. A more detailed comparison will show more clearly all the characteristics of a condenser and its behavior.

- 1. The two tanks supply mechanical pressure measured in pounds per square inch, analogous to the storage battery supplying electrical pressure in volts.
- 2. The two halves A and B of the cylindrical vessel are analogous to the two plates A and B of the condenser.
- 3. The membrane M, separating A and B, is analogous to the insulating material between the plates, and is called the dielectric.
- 4. The quantity of fluid which flows through the pipes P and P₁ is proportional to four conditions: (1) the capability of the membrane to stretch under pressure, (2) the amount

of pressure applied, (3) the thickness of the membrane, (4) the area of the membrane.

- Let K = a measure of the capability of the membrane to stretch
- t = the thickness of the membrane
- s = the area of the membrane
- e = the pressure per unit area on the membrane.

The quantity of fluid flowing through the pipe is proportional to $\frac{\text{e.k.s.}}{t}$. The term $\frac{\text{k.s.}}{t}$ is a quantity pro-

portional to the ability or capability of the membrane M to be stretched by given pressure. The quantity of electricity which flows through the conductors W and W_1 is also dependent upon four conditions: (1) the electrical permeability of the dielectric which varies with different materials, called specific inductive capacity, (2) the amount of electrical pressure applied, (3) the thickness of the dielectric, (4) the area of the dielectric or one of the plates.

- Let K = the specific inductive capacity $\times .08842 \times 10^{-6}$
- t = the thickness of the dielectric in centimeters
- s = the area of the dielectric, or one of the plates in square cm.
- e = the electromotive force in volts
- c = the capacity of the condenser in micro farads

The quantity of electricity in coulombs =

$$\frac{\text{k.s.}}{t} \times e \times 10^{-6} = c \times e \times 10^{-6}.$$

The quantity $\frac{\text{k.s.}}{t}$ is the capacity (c) of the con-

denser expressed in micro farads, and is the measure of the capability of the condenser to retain a charge of electricity at a given pressure. In mechanics the coefficient of elasticity is a measure of the pressure applied to produce a given distortion. Hence the reciprocal of the coefficient of elasticity is a measure of the amount a substance will be distorted under a given pressure, and bears the same relation in mechanics as does specific inductive capacity in electric circuits. Consequently the coefficient of elasticity in mechanics bears the same relation as does specific elastance of a substance in electric circuits.

COOKING BY ELECTRICITY

The extent to which the development of the electrical home will increase the business of the power company is shown in the announcement which accompanied the recent hearing of the Bay Point Light and Power Company's application to increase its rates.

At this time W. S. Van Winkle, president of the company, testified before the California State Railroad Commission that ten per cent of the company's gross revenue was derived from the sale of electric energy for cooking purposes. The company which operates in the towns of Bay Point and Clyde, Contra Costa county, is very much in favor of the electric cooking idea and is proud to state that this is the greatest revenue percentage from cooking on record. This goes to show that the housekeepers of the West are keeping pace with the men of industry in applying electricity to every phase of home and business life.

Steam Power Plant Tests—III.

BY H. L. DOOLITTLE

(Following is the third and last instalment of data compiled from a number of important tests made at a large steam power plant. The author is steam power plant specialist with the Southern California Edison Company.—The Editor.)

Ratio of Oil and Steam Pressures —

A short run was made to determine the effect of varying steam pressure on the steam and oil pressures at the burner. Pressure gauges were installed on the burner side of the regulating valves so as to give the actual pressure of the oil and steam at the burner tip.

The accompanying chart shows the results of simultaneous readings of the pressures on the steam and oil headers and also the pressures of the steam and oil at the burner. During this test the steam header pressure was varied while all other regulating valves were left unchanged. These curves show very clearly that with an inside mixing burner, such as the Hammel, the oil pressure at the burner is affected to a great extent by any change in the steam pressure.

The boiler test made on 1/4/15 consisted of three runs made with different ratios of steam and oil header pressures. These pressures on steam and oil headers were respectively, 148 lb., 50 lb.; 122 lb., 41 lb.; 102 lb., 41 lb. The combustion during these tests appeared to be practically constant as the CO_2 varied only .32%. There was also very little difference noted in the boiler efficiency showing that variation in oil and steam pressure ratios, within certain limits, have practically no effect on efficiency.

Radiation Test —

On 3/24/15 a six-hour run was made to determine the amount of oil required to keep up full steam pressure with the boiler cut off of the header. In this test a small burner having an oil slot $\frac{3}{8}$ -in. wide was used. This burner was operated at intervals as required to keep the boiler pressure within the limits of 199 to 212 lb. It was required to operate the burner a total of 2 hours and 57 minutes out of the six hours and there was used 223 lb. of oil or an average of 37 lb. of oil per hour. This, therefore, represents the radiation losses on boilers kept up to header pressure but not delivering any steam. It is evident that the radiation loss would be somewhat greater than this with the boiler operating under normal conditions on account of the higher furnace temperature.

Swinging Load —

On 3/18/15 a seven-hour test was made on one boiler to determine the efficiency of a fluctuating load.

During this test the load varied from approximately 90% to 140% of rating and for 42 minutes during the noon hour the fires were shut down completely. The results of this swinging load test show that the boiler efficiency was approximately 8% lower than the combined efficiency of boiler and economizer, and approximately 6% lower than the corresponding efficiency obtained under normal operation.

Starting Up Cold —

In order to determine the amount of oil required to bring a cold boiler up to header pressure, a run was made on 1/13/15 on a boiler that had been shut down for 48 hours.

The water in this boiler just before the test was at a temperature of 148°. The boiler was brought up to header pressure in 62 minutes after the time of starting and during the period 1,497 lb. of oil, or 190 gallons, were burned. It was also noted that the water in the gauge glass rose $7\frac{1}{2}$ in. from the time of starting until the time of obtaining header pressure. The pressure in the boiler started to rise 25 minutes after the beginning of the test.

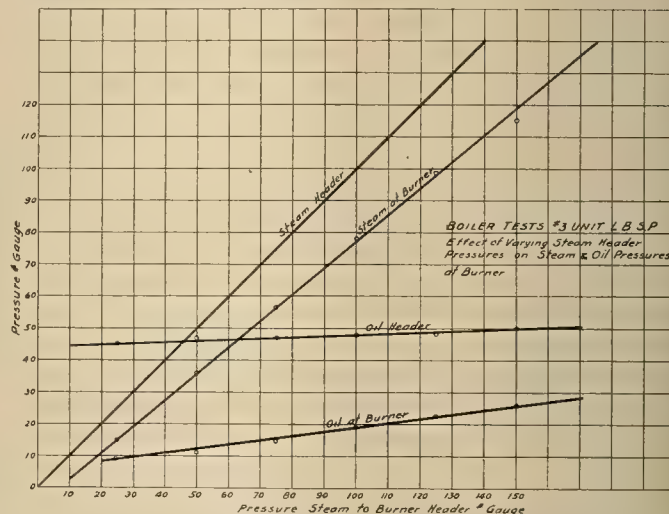


Chart showing the results of simultaneous readings of the pressures on the steam and oil headers and also the pressures of the steam and oil at the burners.

Hot Water to Economizers —

In this test it was endeavored to show the effect of hot water entering the economizer on the rise of temperature of the feed water in the economizer. The average temperature rise in the feed water through the economizer was 80°. Although the temperature rise to the economizer was not found to vary with the load on the boiler in any regular manner, the rise obtained during this test appears to be lower than that which would be obtained under normal conditions.

Test of No. 1 and No. 2 Units

In the test of the No. 1 and No. 2 units, the 15-ton platform scales were used to weigh the water supplied to the boilers. As there was only one set of scales available, the Worthington water-weighers had to be relied upon to measure the condensate returned from the turbines. In this way it was intended to obtain the steam used by the steam driven auxiliaries by subtraction, the make-up water and condensate from the total water fed to the boilers.

However, as before stated, it was found that the water weighers gave very unreliable results although they were calibrated before the test was made, consequently it was impossible to determine either the auxiliary steam or the water rates of the turbine

with any reasonable degree of accuracy. The figures for condensate, make-up water and steam from auxiliaries on the data sheets have therefore been questioned as these quantities were obtained from the meter readings.

Problem Course in Electricity

BY H. H. BLISS

(The working out of a practical problem does more to fix an electrical law in the mind than prolonged theoretical reading. The following article, the third of the series by the supervisor of the department of vocational education of Nevada, takes up voltage drop and other characteristics of series circuits, and concludes with a number of practical problems involving a use of the principles discussed.—The Editor.)

SERIES CIRCUITS

Three Special Laws.—In solving problems related to circuits in which the same current goes through several parts in succession we must keep clearly in mind the three forms of Ohm's Law as well as the three special laws of simple series circuits: (1) The number of amperes at any instant is the same in every part of the circuit; (2) The resistance of a series circuit is equal to the sum of the resistances of the several parts; (3) The pressure applied to a series circuit is equal to the sum of the voltages across the several parts. Note also that Ohm's Law applies to the circuit as a whole: Volts applied to circuit = amperes \times total ohms.

As an example of this sort of circuit, take the connection of a telephone transmitter in a "local battery set." (The instrument, shown in Fig. A, has a variable resistance, for when sound waves shake the flat plate behind the mouthpiece the carbon grains in the box at the rear are alternately pressed and released. Carbon has the peculiar property of greatly lowering in contact resistance when the surfaces of the granules are squeezed together.) The transmitter is connected through three wires and a coil to a 3-volt battery (2 dry cells).

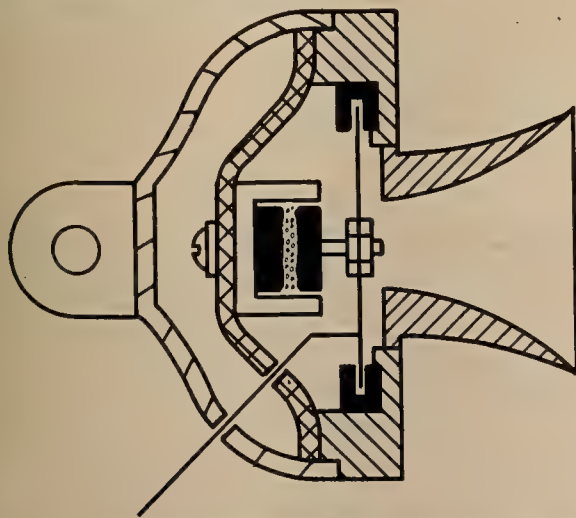


Figure A. A diagram showing the connection of a telephone transmitter in a "local battery set."

Assuming that the coil has 1.1 ohms resistance and each of the three wires .1 ohm, what is the resistance to which the battery voltage is applied when the transmitter has 40 ohms? What current flows in the coil? in the transmitter? What pressure is

applied to the coil? Adding resistances, $.3 + 1.1 + 40 = 41.4$ ohms; current = $3/41.4 = .0724$ ampere. This is the current at that instant in the transmitter and also in the coil, for they are in series. The pressure across the coil is $.0724 \times 1.1 = .0796$ volt.

Other Examples.—A 21 candle power automobile lamp is built to take 3.5 amperes from a 6 volt battery. If it is desired to operate this lamp on a 112

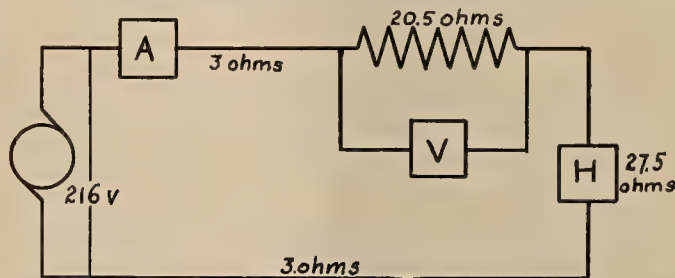


Figure B. A diagram of a 216-volt generator which sends current through two line wires of 3 ohms each, a resistance of 20.5 ohms, and a heater of 27.5 ohms.

volt house lighting circuit, what resistance must be inserted in series? Lamp resistance = $6/3.5 = 1.7$ ohms. Total resistance needed = $112/3.5 = 32$ ohms. As a check on the work, note that the voltage across the lamp = $3.5 \times 1.7 = 6$; that across the resistance = $3.5 \times 30.3 = 106$; adding these voltages we get 112.

The 216 volt generator in Fig. B sends current through two line wires of 3 ohms each, a resistance of 20.5 ohms, and a heater of 27.5 ohms. Find the reading of the voltmeter, V. The circuit resistance is 54 ohms, and hence the current = $216/54 = 4$ amperes; the pressure needed to force 4 amperes through 20.5 ohms is 82 volts, which is the reading of the meter.

For street car lighting the voltage used is generally 550, and hence five 110 volt lamps are connected in series in each lighting circuit. If each has 500 ohms, the current is $550/2500 \times .22$ ampere. If now one lamp is replaced by one of higher candle-power which normally takes 1.34 amperes at 110 volts, what current will flow and how will the voltage be distributed? The new lamp has $110/1.34 = 82$ ohms; total for the circuit = $82 + 4 \times 500 = 2082$. Current = $550/2082 = .264$ ampere. Voltage across the new lamp = $.264 \times 82 = 21.7$; across each of the others it is $.264 \times 500 = 132$ volts. The four lamps will quickly burn out, and the new lamp will in the meanwhile give practically no light. A com-

plete check on the solution is obtained by adding the voltages: $21.7 + 4 \times 132 = 550$ —.

Drop in Pressure.—Imagine a long horizontal line of pipe full of water, with a pump trying to force water in at one end (call it end A) and a closed valve at the other end (B). A simple test with pressure gages or manometers shows that the water pressure is exactly equal at A and B as long as no water flows. But if the valve at B is opened a little, the pressure gage there immediately reads lower than the gage at A. There is a "pressure drop" along the pipe due to the flow of water. If the flow increases the "drop" becomes greater, that is, the difference between the pressures at A and B depends upon the rate of flow of the water.

In an analogous way the voltage between a trolley wire and the track is exactly the same at the far end of the line as the power house, so long as no current flows. But as soon as current starts in the line, the pressure at the distant point drops below the generator voltage, and the amount of the drop is proportional to the number of amperes.

This is readily understood by referring to Fig. B. When 4 amperes flow it must take 12 volts to drive the current through one line wire ($4 \times 3 = 12$), 82 volts to drive it through the resistance coil, 110 volts to drive it through the heater, and 12 more for the return wire. The sum of these figures is 216, the generator voltage. Obviously if 24 volts are required to get the current through the line, the pressure across the load (heater and coil) is 24 volts lower than that at the generator.

If the resistance coil is removed and the upper wire connected to the heater, the total resistance becomes 33.5 ohms and the current 6.45 amperes. The drop in the line becomes 6.45×6 ohms = 38.7 volts, leaving only 177.3 at the load.

Rule: The line drop (or difference between voltage at generator and that at load) = amperes \times total line resistance (both wires).

Example.—The motors of an interurban train take different amounts of current, depending upon the speed, gradient, etc. If the voltage at the power house is 1230, the resistance of the trolley wire 1.2 ohms, and that of the track .6 ohm, what is the voltage at the train when it takes 0 amperes? 20 amperes? 70 amperes? Line drop = $1.8 \times$ current, or 0, 36 and 126 volts in the three cases, leaving train voltage 1230, 1194 and 1104 volts.

Answers to Second Problem Set

11. 60,000 ohms.
12. (a) $9/.006 = 1500$ amperes; (b) (Deleted by Censor).
13. Amperes \times ohms = .0221 volts = 22.1 millivolts.
14. $.040/.000032 = 1250$ amperes.
15. Resistance = $108/.735 = 147$ ohms; $8.5 \times 147 = 1250$ volts.
16. The voltage was at least 105 volts.
17. Resistance = $220 \div 1/4 = 880$ ohms. (Note that dividing by $1/4$ is not the same as dividing by 4). $550/880 = .625$ ampere.
18. 55 ohms; 80 ohms; 256 ohms.
19. $240/.0062 = 38,700$ ohms.
20. If 3 gallons per second pass one point, the same amount must pass every other point in the same time, or else there would be an accumulation or a deficiency of water somewhere in the circuit. Hence the answer is "Yes."
21. 30 and 32 volts.
22. 13.4 and 14.3 mil-amperes.

Third Problem Set

23. No. 30 copper wire is listed as having 103 ohms per thousand feet. What is the resistance of one foot? of 670 ft.?

24. Fifty lamps are connected in series. One takes 6.6 amperes; what does the next one take? The pressure across each lamp is 37 volts and the current leaves the substation at 1880 volts. What is the resistance of the line and of each lamp?

25. What are the "ohms per thousand ft." of a wire in which there is a drop of 4 volts when 8.7 amperes flow through a piece 230 ft. long?

26. The safe current for a certain piece of apparatus of 8.5 ohms resistance is 6.7 amperes. What must be done if it is to be used on a 215 volt line?

27. A certain house is supplied with lighting current at 218 volts. It is desired to use 110 volt lamps, as they last better than 220 volt lamps. Hence at each outlet two sockets are connected in series. What is the result of using a 202 ohm, 110 volt, lamp in one socket and a 475 volt lamp in the other? (Find current and voltage for each lamp.)

28. The voltage at a certain distribution center was 112.82; in a nearby house where a current of 7.3 amperes was being used the pressure was 109.5 volts. Find the resistance of each of the wires.

29. If a 550 volt motor takes 67.2 amperes, how far is it away from a 600 volt generator if each of the line wires has .248 ohm per thousand ft.?

30. A mine locomotive operates in a tunnel 700 ft. underground. The trolley wire has .05 ohm per 1000 ft.; the track .01 ohm per 1000 ft.; the wire used to carry the current down the shaft has .02 ohm per 1000 ft. The ammeter and voltmeter readings at the train when it is 1600 ft. from the shaft are 130 and 214 respectively. What is the voltage at the generator at the top of the shaft?

31. A man whose body resistance was 5000 ohms got himself into a circuit to which 115.5 volts was applied. He expected to be "protected" from a severe shock because he was in series with two lamps of 250 ohms each. Find the drop in the lamps and the voltage applied to the man.

32. A generating station is located at a distance from the center of a town, where it is desired that the lighting voltage be kept constant at 116. The operator is instructed to make the generator pressure 120 volts when the load is 140 amperes. What is the resistance of the line, and what should be the generator voltage for loads of 30 and 200 amperes?

Western Ideas

THE VISITING DEALER can be greatly helped by the manufacturing company in planning his window displays. The picture below is a window which has been developed by the Dealers' Help Department of the Benjamin Electric Manufacturing Company. It is on exhibition at the company's executive offices in Chicago, and is one of a series of exhibits being prepared for the benefit of visiting dealers.



This is a demonstration of the simplicity and ease with which a really attractive window can be developed from the material furnished to dealers by the company. The use of the double way convenience outlet is shown here to great advantage.

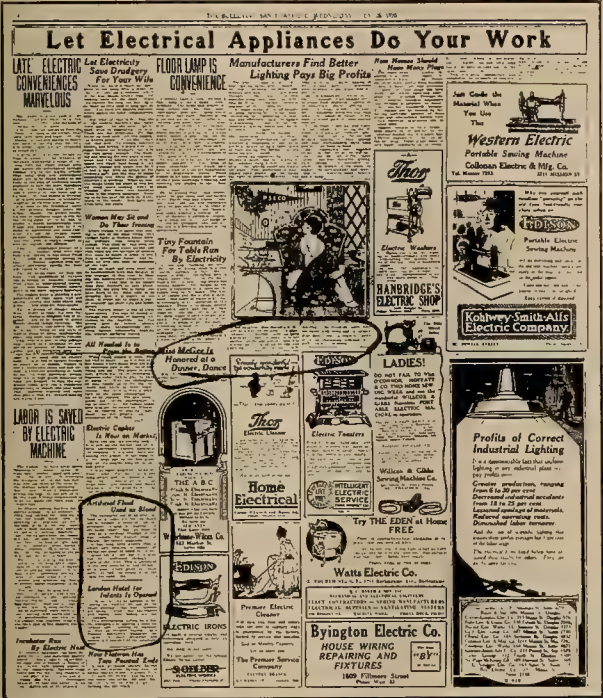
Advertising

BY HOWARD W. ANGUS

(Which advertising medium reaches the greatest number of prospective buyers? In the following article, the second of a series on advertising, the secretary of the California Electrical Cooperative Campaign takes up the special advantages of newspaper advertising and the way in which it should be handled.—The Editor.)

Newspaper advertising has been called the heart of the retail business. Certainly it is one of the most important, if not the most important medium of advertising for the contractor and dealer. Through the newspapers you can keep your name before practically all the people of your city all the time—a feat that can be accomplished in no other way. This medium at least must be used if you expect successfully to develop, and to expand into a position of prominence and influence in the retail merchandising world. Everybody owning a home, a store or a factory reads the newspapers. Probably you would like

resulted in buying action would depend entirely on how much of a desire you created in their minds for the goods you had to sell. Certainly if you repeated that process every morning you would get different people to listen through your story each day, with the result that in a month or two months' time everybody had at least heard your story. That is just what happens to an advertisement in the newspaper. Some never see it, of course. Some merely glance at it. Some read part of the written word. Others read it all. Some of these read it and buy. The more often the advertisement appears the more



An example of an electrical page in a daily newspaper that has too much electrical news and not enough news of interest. Such a page would not attract the interest of the casual reader.



The same page as it appeared in a later edition of the paper. This page has a large amount of very interesting news but a minimum of electrical news.

to know what effect an advertisement run in a newspaper has upon the people. We will suppose that you could make arrangements with the telephone company so that all of its subscribers in your city would be connected up with your desk for a minute every morning and that during that minute you had the privilege of telling these people anything that you wished about your business. Some of them would never hear their phone ring. Some would hang up the moment you began to speak. Others would wait to hear who was talking. Others would wait a little longer to hear your story. During the telling of your story from time to time those at the other end of the line would hang up. Some would listen to the whole story. How long you could get the majority of people to listen would depend on how your introductory remark caught their attention, and how much your remarks interested them. Whether the conversation

likely is everybody at some time or other to read and get your story, and the larger the number becomes of those who actually buy.

Buying Customers

In a newspaper you are buying readers just as you were buying hearers in the assumed telephone conversation. So the first fact that you want to know about a newspaper is how many readers it has and the cost of reaching those readers. Suppose there are two papers in your city; one has 10,000 circulation and the other 25,000 circulation, and that the rate on the first paper is 25c. an inch, and on the other 50c. an inch. Everything else being equal, it is quite evident that the newspaper with the 25,000 circulation at 50c. an inch is giving you more for your money than the newspaper with the 10,000 circulation at 25c. an inch. The 25,000 circulation news-

paper is giving you 12,500 readers for 25c. as against 10,000 readers in the other paper.

However, another point should be taken into consideration, and that is how many readers of the newspaper are prospective buyers. We will again assume that the newspaper with the 10,000 circulation is entirely confined to the city in which your store is located, but that the circulation of the other newspaper covers a large territory and is distributed in many other towns which are adequately supplied by electrical stores. We will suppose further that the newspaper with the 25,000 circulation has a 10,000 circulation in your city and that the other

made by the national Audit Bureau of Circulation for the information of national advertisers who are spending millions yearly. It pays them to know. It will pay you. You should know what you are buying in newspaper space as well as in goods. Newspaper space is sold just the same as merchandising is, and quantity purchases bring their discount. By laying out your advertising program in advance and signing a contract for the amount you should use, and intend to use during the year, you can save as much as 20%. Lay out your advertising program, study the rates, and buy your space like a business man.

I do not want you to gain the impression that you are only to use one newspaper. You should use all if possible, because what you want is 100% saturation in your city if possible. Two newspapers will do that better than one and three better than two. In large cities where there are four newspapers and it is impossible for a dealer to use all of them, there are three crosses that can be used with success. First, the newspapers can be divided into the morning and afternoon fields. By using the two morning papers you are safe in believing that approximately 75% of the home circulation will reach the homes. By using the afternoon field you are also sure of the same result. Another cross that is very successful is that consisting of one morning newspaper and one afternoon newspaper. In this you are subject to some duplication, but you are appealing to the readers of both fields and catching them both in the morning and in the evening.

Persistence and Profit

Having made your appropriation and picked your newspaper, the next decision which you should come to is to do a thorough job. Unless you are going to advertise in the newspapers consistently and persistently, you might just as well save your money. Spasmodic advertising—by that I mean such advertising as once a month or only during one month of the year—is not a wise expenditure of money. Advertising experts will advise you that approximately 5% of the readers of any one edition of the newspaper will see your advertisement. That is not very many, and that is why spasmodic advertising is foolish. But if you advertise at least once a week, the 5% will consist of different people each time who read your advertisement; experience has shown that the number who read it increases, so that before a year's time you have secured 100% saturation. That is why people say that advertising must be persistent, that its effect is cumulative, and that the results of advertising can only be judged by looking at your trial balance sheet at the end of each year. You are selling electric appliances and wiring 365 days in the year. You would not think of keeping your store open only one month of the year or during one day in the month.

By advertising year in and year out your store will become better known and patronized by more people. The best known store is invariably the best advertised store. Department stores also had small beginnings. They did not spring up full grown over

Electricity Big Labor Saver for Tired Housewife

POWER PROVIDING GREAT HELP IN REDUCING WORK

Washing Machines Washwoman Uses Unseen Power

Power Cooking on Electrical Range

Make Child's play of washing day - the FEDERAL ELECTRIC

Home Electrical

Roberts Manufacturing Co.

Electricity Big Labor Saver for Tired Housewife

Power Cooking on Electrical Range

Make Child's play of washing day - the FEDERAL ELECTRIC

Home Electrical

Roberts Manufacturing Co.

Another electrical page that has the proper amount of electrical news with good, interesting news items mixed in. Such a page will attract attention and the reader will read some of the electrical news and look over the advertisements.

15,000 goes into other cities. Then it is quite evident that the paper with the 10,000 circulation at 25c. an inch is a much better buy than the paper with the 25,000 circulation at 50c. an inch; for in that case you are buying 10,000 possible purchasers in each newspaper.

Another point that should be taken into consideration is the character of the circulation of the newspaper. In large cities several editions are printed; some of these go into the home and some are sold on the street. The street circulation as a general rule, with the exception of the edition that appears on the street about 5 o'clock, when people are on their way home, never reaches the home and, therefore, is not so valuable to the electrical contractor and dealer. What you are interested in is the number of newspapers that are delivered at the home, and the street editions that are carried home.

You will find such facts as these in what is known as the A B C report or the sworn detailed circulation. The A B C report gives just where, when and how the newspaper is delivered. This report is

night. One thing that every successful department store has done is this—it has advertised and then advertised some more.

An Intelligent Plan

Advertising should be built according to a plan, just like a home. While you should advertise every month, there are some months when you should do more advertising than in the others. In California there are certain well defined months in which your advertising should be heaviest. Beyond a question of a doubt October, November and December are the months when you should use the most advertising space, leading up to your Christmas campaign. It would not be a mistake to use twice as much advertising space during those three months as during any other three months of the year. The other months that seem to call for a larger advertising display are April, May and June of the Spring campaign. So in laying out your newspaper advertising appropriation for the year, be sure and allow for large advertising during October, November, December, and increased advertising during April, May and June.

At the first of each year you should think out and form your advertising schedule. This should not be a hard and fast schedule but one that may be departed from as occasion arises. To give a better idea of what I mean by schedule, I will quote the merchandising advertising schedule prepared by the National Electric Light Association:

January—Clearance Sale.
February—Heating Pads.
March—Vacuum Cleaners.
April—Sewing Machines and Sewing Machine Motors.
May—Grills.
June—Irons.
July—Fans.
August—Clearance Sale.
September—Washing Machines.
October—Radiant Heaters.
November—Toasters.
December—Electrical Christmas Gifts.

Don't think that you should necessarily use this schedule; certainly a contractor would not. It is given as a suggestion and a basis to start from in working out your schedule. Certainly you should write to your jobbers and manufacturers and secure from them their national advertising schedule. By tying-in with them you gain the benefits of having all the people in your town who subscribe to such magazines as the Saturday Evening Post or the Ladies' Home Journal, read in those magazines about the goods you sell, and pick up the daily newspaper and find out that these articles can be purchased in their own city at your store. That makes advertising like hunting with a double-barrel shotgun instead of with a rifle.

COMING CONVENTIONS

Northwest Electric Light and Power Association—
Spokane, Washington, September 8-11
State Chapters of the American Association of
Engineers—
Everett, Washington, August 24
National Association of Electrical Contractors and
Dealers—
Baltimore, Maryland, October 4-9

MOTHERS, "KIDS" AND ELECTRIC CLOTHES WASHERS

BY GERALD F. CHAMP

It has often been said that the quickest way to reach the heart of a man is through his stomach and it is a proven fact that one of the surest ways of interesting mothers is by enlisting the aid of their little ones. Taking the last fact as its cue the Southern Electrical Company, of San Diego, California, conceived an electric clothes washer advertising feature that has proved itself not only a good publicity stunt but a splendid prospect getter as well.

The Blue Bird and Eden electric clothes washer Miniature Model contest featured by the concern from March 30th to April 14th was open to any boy or girl under 16 years of age residing in San Diego county.

The object of the contest was to interest the children in making miniature models of the store's two most popular and best known makes of electric clothes washers. The models to be any size between four and twenty inches high and of any material the maker might see fit to use. Models to be solid or hollow. Although it was not expected that working models be submitted several very well executed models of this nature were made and the perfection was commendable indeed.

The basis of scoring the contest was fifty points for correct scale dimensions and fifty points for correct general appearance, covering lettering, finish, and color.

A 4-column by 13-inch announcement was run by the store in the three local papers, along with a free news story, giving complete details and rules of the contest. This announcement was followed several days later by another smaller advertisement calling attention to the closing date of the contest.

Of course the outstanding feature of the stunt is that it introduces the electric clothes washers sold by the concern featuring the contest in homes that would have been difficult to reach through any ordinary sales plan.

In fact, many women visited the Southern Electrical Company to see the machines, and told the clerks that they came as the direct result of their children's participation in the contest, saying that they had never been interested in electric clothes washers before. Several hundred boys and girls inquired at the stores for pictures to work from and other information. This afforded a splendid method of introducing literature into the homes and doubtless there was plenty of washing machine discussion as the direct result.

As soon as the models were completed and brought to the stores they were immediately put on display in the windows and the comments heard from passers-by were worth the value of the prizes offered for the contest.

Many excellent prospects were secured that have since been turned into sales and as said before, the advertising value of the contest was well worth a great deal more than the value of the prizes. It's a stunt that will be profitable to any electrical concern.

SPARKS—Current Facts, Figures and Fancy

(The sea is harnessed for the production of electrical energy; houses are built of tin cans; explosives are used in agriculture and radium will put you to sleep. These startling facts and others like them are explained on the following page along with items which tell of the growing motion picture industry of Italy, the harnessing of French waterfalls and the surprisingly high cost of running an automobile.—The Editor.)

Ten cent street car fares are now being paid in fifty-nine cities in the United States. Recent tabulation shows that increased fares have been granted in 460 cities.

* * *

Tin can houses are becoming the style in a section of Montenegro. The natives have found that old gasoline containers and tomato cans flattened out make very good fireproof houses.

* * *

Showing that America is as popular as ever with the rest of the world, recent immigration statistics state that immigrants are arriving in this country at the rate of about 10,000 a week.

* * *

A reform in the production methods of the tea industry is being instigated by the government of China. A tea bureau has been established and a tea college is to be founded. All this is largely because of the fact that India and Ceylon have captured nearly all of China's tea trade.

* * *

A system of three waterfalls in the Valley of the Ossau, France, is being harnessed in order to obtain water power for the electrification of the Chemin de Fer du Midi. The cost of the work is estimated at 100,000,000 francs, and the project will be completed within five years.

* * *

The question, What does it cost you to run your automobile? has been answered by a recent compilation made from carefully kept records of over 300 cars. The answer is that the present cost of operation, not allowing anything for overhead, depreciation or replacing, is 7.1 cents per mile.

* * *

Tunnel commutation will soon become the fad among Pittsburgh workers when the twin tunnels, each 5,700 feet long, through the range of hills bordering the Monongahela River valley, are completed. Thousands of workers who live in the southern part of Allegheny county will make use of these tunnels daily.

* * *

We with our modern bank notes are not so far ahead of the ancients, after all, for the first piece of paper money was issued in China 1269 years ago when America was a wilderness. The note is more than a foot long and bears the arrogant inscription, "Circulating forever and ever." The colors are still bright and the gold ink as shiny as the day it was applied.

The discovery that certain large deposits of lignite or immature coal in Devonshire, England, can be used as a smokeless fuel will make it possible to generate electric power at an unusually low cost. A \$5,000,000 copper refinery is to be set up on a site where the requisite electrical energy can be generated from deposits of 800 million tons of lignite.

* * *

Reminding us that it is an ill wind that blows nobody good, Italy is planning to dispose of her surplus supply of explosives in preparing her land for large scale agricultural projects. In addition to preparing the land for cultivation, it is claimed that the use of certain explosives destroys parasites and to a certain extent reduces the necessity for fertilization.

* * *

People in Germany are being put to sleep through the aid of a Radium Sleep Button, at least a high class German periodical is advertising a contrivance which is nothing more than an ordinary "Radiolite" button upon which the owner is supposed to gaze until hypnotized when he falls sound asleep. It has been further suggested that those who have not a Radiolite button try using their watch for this purposes if it happens to have its hands coated with radium paint.

* * *

Even the sea is to be harnessed for the production of electrical energy, according to reports which come from the west coast of England. Here a number of estuaries have been surveyed with a view to installing turbines which work by the tidal ebb and flow. The tide makes the power at both its inflow and its outflow, only ceasing for a comparatively short time during the period of half tide. In certain districts the great variation in the hour of the tide at neighboring estuaries makes possible the production of maximum energy during an almost continuous period.

* * *

The United States of course claims first place among the nations of the world in the manufacture of motion pictures, but Italy is taking her place as a very close second. An idea of the importance of this industry in the economic life of the country can be derived from the fact that the working capital employed is now estimated at 300,000,000 lire and the actual capital invested at 100,000,000 lire. There are 82 companies engaged in the production of films, of which the greater number are located at Rome, which naturally presents unusual advantages from the scenic standpoint. The annual production of new films in Italy has reached 1,600,000 meters, and if it is estimated that 40 copies are made from each negative the total of printed films is 64,000,000 meters.

PERSONALS



Franklin T. Griffith, president of the Portland Railway, Light and Power Company and for the past year chairman of the Water Power Development Committee of the National Electric Light Association, has been reappointed to that position. This reappointment goes to show that the value of the splendid work which has been done by Mr. Griffith during the past year is recognized. In connection with his work as chairman of this committee, Mr. Griffith is now in Washington, D. C., attending a conference of the national water power commission, created by recent act of Congress. The purpose of the conference is to consider regulations to govern the acquisition of water power rights and procedure to be followed in developing hydroelectric power properties. The commission is composed of the secretaries of war, agriculture and interior, and the Portland conferees are members of the National Electric Light Association committee specially created to meet with the federal commission.

Dave Harris, sales manager of the Pacific States Electric Company, has recently returned from the East where he attended the General Electric Company sales conference on Convention Island.

O. L. Le Fever has been appointed superintendent of the Northwestern Electric, at Portland, to fill the position made vacant by the promotion of Mr. Merwin, and **E. F. Pearson** has been made assistant to the superintendent.

L. T. Merwin, formerly general superintendent with the Northwestern Electric Company, has been made assistant general manager of the company and is at present acting as general manager in the absence of **G. C. Pierce**, general manager.

F. B. Tough, petroleum technologist, U. S. Bureau of Mines, in charge of the cooperative work being carried on by the Bureau with the Midwest Refining Company and the Ohio Oil Company in Wyoming, spent two weeks in California recently visiting the various oil fields and gathering data in connection with his work in Wyoming.

Earl Fisher, assistant manager of the commercial department of the Pacific Gas & Electric Company, has been appointed manager of this department. Mr. Fisher has always been very active in the commercial field, being chairman of the commercial section of the Pacific Coast Section of the National Electric Light Association.

Lee H. Newbert, manager of the commercial department of the Pacific Gas & Electric Company, has been appointed manager of the Alameda District. Mr. Newbert is the president of the Pacific Coast Section of the National Electric Light Association and chairman of the Advisory Committee of the California Electrical Cooperative Campaign.

W. A. Brackenridge, vice-president, Southern California Edison Company, **Franklin T. Griffith**, president, Portland Railway Light and Power Company, and **Guy W. Talbot**, president, Pacific Power and Light Company, have left for the East where they will attend a conference to assist in the formulation of a set of laws to carry out the purposes of the water power bill which has recently been signed by the President.

C. D. Slaughter, secretary of the Allied Industries, Inc., leaves on the fifteenth of August for Pawtucket, Rhode Island, where he will attend a sales conference of the Tubular Woven Fabric Company. Mr. Slaughter will also visit all of the other factories which his company represents on the Pacific Coast.

Frank A. Leach, manager of the Alameda District of the Pacific Gas & Electric Company, has been appointed assistant general manager of that company. Mr. Leach has been manager of the Alameda District since 1904, at which time it merely embraced the cities of Oakland, Alameda and Berkeley. The district now covers three counties, being the largest of all Pacific Gas & Electric Company districts.

J. C. Hoyt, hydraulic engineer in charge of the surface water department of the U. S. Geological Survey, who was in Salt Lake City recently on an inspection trip, predicted a big development in water power to the great advantage of the West. Almost unlimited possibilities are to be found in the West, he said, and with this development the public would turn more to the use of electricity, and other methods of obtaining power which would ultimately supplant the use of steam.

W. E. Blodgett, secretary-treasurer of the Utah Light & Traction Company, has been appointed comptroller of the Winnipeg Electric Railway Company of Winnipeg, Manitoba, Canada. This is one of the largest street railway systems in Canada, and Mr. Blodgett's position is one of the most important in the company. Mr. Blodgett has had long experience with the Utah Light & Traction Company and other companies, and is also naturally well equipped with ability in street railway accounting.

Wigginton E. Creed has been elected to succeed **Frank G. Drum** as president of the Pacific Gas & Electric Company, the latter having resigned on account of the great amount of time demanded by the various interests in his charge. Mr. Drum has been president of the Pacific Gas & Electric Company since 1905 when it was known as the California Gas and Electric Corporation. Mr. Creed, who succeeds Mr. Drum, is the attorney president of the Hooper Lumber Company and is interested in the East Bay Water Company of Oakland. He also formed the Columbia Steel Company of Pittsburg, California. Shortly after Mr. Creed's appointment he was the guest of honor at a banquet at the Palace Hotel in San Francisco given by Mr. John A. Britton, vice-president and general manager of the Pacific Gas & Electric Company to the board of directors, heads of departments and district managers of the company.

F. D. Fagan, formerly Pacific Coast sales manager of the General Electric Company and president of the California Industries Association, has been appointed vice-president of the Edison Storage Battery Company, with headquarters at Orange, New Jersey. He is leaving for the East on the fifteenth of August. Mr. Fagan, a native of California, has been with the General Electric Company for twelve years, having entered its employ as a solicitor in the lamp department. He has attracted attention through the plan he has originated of



lecturing upon efficient and economic incandescent lighting in connection with his work, and also as founder of Edison day which is now observed annually throughout the country on October 21, the anniversary of the invention of the incandescent electric light by Edison.

Walter F. Price, architectural representative of the California Electrical Cooperative Campaign, has charge of the building of the electrical homes that are being built in Oakland, Sacramento and other towns in the state. Mr. Price has done excellent work in selling the electrical home idea to the architects and home builders and the electrical home that is being demonstrated in St. Francis Wood is a result of his work with Mason-McDuffie Company of San Francisco. Mr. Price is a graduate of the Van Der Naillen School of Engineering



and for nine years was in the employ of the Pacific Telephone & Telegraph Company as engineer of outside telephone plants. He has been with the California Cooperative Campaign since February of this year and the good work being done by him is noticeable in the increased number of convenience outlets now being installed in the houses under construction.

Rudolph Van Norden, consulting engineer in San Francisco, has taken a business trip East.

A. B. Macbeth, vice-president of the Los Angeles Gas and Electric Company, was a business visitor in San Francisco lately.

W. E. Freeman has been appointed director of commercial training of the Westinghouse Electric & Manufacturing Company.

A. H. Kahn, purchasing agent of the Pacific States Electric Company, is visiting the Portland and Seattle offices of his company.

J. O. Case, local sales manager, General Electric Company, Los Angeles, was in San Francisco lately to attend to a business conference.

D. A. Lyon, supervisor of stations, U. S. Bureau of Mines, has recently visited the San Francisco and Berkeley offices of the Bureau.

P. H. Booth, Pacific Coast sales manager, Edison Electric Appliance Company, has returned to the Coast after spending some time at the Chicago office.

R. W. Conlisk, illumination engineer, Westinghouse Electric & Manufacturing Company, has returned to San Francisco from the company's lamp works.

George K. Weeks has resigned from the board of directors of the Pacific Gas & Electric Company. This resignation was made in order to make place for the new president of the company.

Fred Todd, sales manager of the Portland office of the Pacific States Electric Company, has just returned from a business and pleasure trip to California, having driven down in his car.

L. R. Ardouin, lately secretary of the San Francisco Association of Electrical Contractors and Dealers, is now with the United States Steel Products Company with headquarters in San Francisco.

G. C. Pierce, vice-president and general manager of the Northwestern Electric Company at Portland, is away on a leave of absence to be at the bedside of his wife in southern California, who is quite ill.

A. V. Kipp, general agent, freight and passenger departments for the Oregon Short Line at Butte, has been appointed general freight and passenger agent for the Orem Electric lines at Salt Lake City. Mr. Kipp has had about twenty years' experience in the railroad business, having started with the Union Pacific at Denver twenty years ago as traveling freight agent.

N. Sigimura, electrical engineer of Tokio; and S. Kobori, mechanical engineer of the same city, have been touring the United States studying the latest developments in hydro-electric construction methods.

Gilbert H. Grosvenor of Washington, D. C., president of the National Geographic Society and editor-in-chief of the National Geographic Magazine, is a San Francisco visitor. Mr. Grosvenor has been a prolific writer on scientific subjects.

C. I. Kephart, electrical and valuation engineer with the Public Service Commission of Oregon for the past few years, stopped over for several days in San Francisco on his way to Washington, D. C., where he will take up his new position as examiner with the Interstate Commerce Commission.

C. M. Masson, illuminating engineer with the Southern California Edison Company, designed the illumination of the grounds of the Huntington Hotel at Pasadena during the National Electric Light Association convention which brought forth much praise from the delegates, and which was described in a recent issue of the Journal of Electricity. In 1903 Mr. Masson came to California and was associated with his cousin, R. S. Masson, then consulting engineer for all the Huntington interests in Southern California. Mr. Masson has been associated with the Southern California Edison Company since 1912.

Ralph A. Gould, chemical engineer, 216 Pine Street, San Francisco, and Bryant S. Drake, chemical engineer, 14 Montgomery Street, announce their association, from August 1st, 1920, as a partnership under the firm name of Gould & Drake, Chemical Engineers, with offices at 216 Pine Street, San Francisco. Mr. Drake was formerly chemical engineer of the Union Iron Works, San Francisco.

Michio Izawa, assistant traffic manager for the Japanese government railroads of Tokio, and Kukujiro Hirayama, railway engineer of the imperial lines of the same city, are in the United States studying modern railway methods. They are paying especial attention to the electrified lines that are proving so successful in the United States, as Japan's fuel supply can only last about fifty years more and the mountainous districts have great possibilities for hydroelectric development.

Roy J. Heffner, who has had charge of the technical department of the University of California Extension Division, with Mrs. Heffner sailed some time ago to take up a position as Educational Expert with the U. S. Army, and will have charge of the vocational training of the army barracks at the Hawaiian Islands. Major Heffner, who is a member of the firm of the Technical Service Co., served during the war in the Signal Corps where he had extensive experience in wireless work. Part of this experience was embodied in a



comprehensive survey in the April 1st issue of the Journal of Electricity. His recent achievements in enlarging and coordinating the activities of the University Extension Division have been of the highest order.

OBITUARY

James Mitchell, one of the pioneer electrical engineers who perfected the electric street railway system of Denver, died recently at his summer home, St. James, Long Island. Mr. Mitchell was president and one of the organizers of the Alabama Power Company and installed the first trolley car system in South America.

Meeting Notices for Electrical Men

(An account and pictures of the San Francisco Electrical Development League's trip over the Hetch-Hetchy project appears on the following pages along with an account of the recent conference at which a combination code for the state of California was considered. Notices of the electrical day recently held at the Los Angeles Ad Club and of the meeting at which a Vancouver Cooperative Campaign was launched are also given here.—The Editor.)

S. F. Electrical Development League Visits Hetch Hetchy

During the summer months the San Francisco Electrical Development League suspended its regular weekly meetings, but that fact did not stop a party of members of the League from accepting the invitation of M. M. O'Shaughnessy, city engineer of San Francisco, to take a trip over the Hetch Hetchy development. The party numbered fifty-four, including the guests, and the trip was managed by A. V. Thompson, railway sales agent, General Electric Company, the official guides being A. J. Cleary, chief assistant city engineer, and N. A. Eckart, construction engineer, in charge of the Hetch Hetchy project.

To assure a fair and impartial distribution of berths, they were drawn for by lot after the train had started, but the committee might as well have saved themselves the trouble as almost immediately the group was divided into the noisy and the quiet car. About the time that the noisy group decided it was time to turn in, the train pulled into Hetch Hetchy Junction where the members of the "Alarm Clock Committee" made themselves unpopular by summoning every one to breakfast.

The first day was spent in visiting the various tunnel portals along the route of the Hetch Hetchy Railroad, winding up at the camp at Damsite. The outstanding features of the first day's journey were, first of all, the appetites that most of the men from the city had forgotten they possessed. Second, the drop down the shaft at Big Creek Camp. Third, the view of the Hetch Hetchy Valley from the top of the tramway at Damsite. Fourth, the number of steps in the walkway from the top of the bluff down to the dams site, and the fact that there were twice as many when they climbed back up. And fifth, the great quantity and excellence of the food served at the camps. "Put out that light."

Leaving Damsite early the next morning the party returned over the railroad on the special observation car provided for the trip, until Early Intake siding was reached. After a breath-taking trip down the tramway the party spent the rest of the morning inspecting the power house, penstock, ditch, and the tunnel at Early Intake where the water will begin its eighteen-mile underground trip. The afternoon was spent inspecting the great work that is being done at Groveland, including the up-to-date hospital, the headquarters building, the railroad shops and the employes' club house. After a sumptuous banquet at the Groveland Hotel at which Mr. Cleary told the history of the development, the party pro-

ceeded to the special train to be carried back to the Pullmans which were waiting at Hetch Hetchy Junction. It was a tired bunch that crawled on board the Pullmans, but happy and enthusiastic over the possibilities of the development and full of gratitude to "Chief" O'Shaughnessy for a wonderful outing.

Oregon Association of Electrical Contractor-Dealers

The regular meeting of the Oregon Association of Electrical Contractors and Dealers was held at the Chamber of Commerce Monday evening, July 12th.

Mr. McMicken addressed the meeting on the Cooperative Campaign, and strongly recommended that the association

send a delegate to the meeting of the advisory committee of the Northwest Electric Light and Power Association to be held in Seattle July 15 and 16.

The American Institute of Electrical Engineers extended an invitation to all members of the Contractor-Dealers' Association to attend the sessions of the Pacific Coast Convention of the Institute being held in Portland.

Mr. McCoy of the Smith-McCoy Electric Co., gave a very interesting report of his recent trip through the East and in conclusion stated that the electric stores in Portland were far ahead of some of the stores in the East.

A general discussion of local conditions was followed by adjournment.

At the regular meeting of the Oregon Association of Contractors and Dealers held on Monday evening, July 26, Mr. Tomlinson, the delegate of the association to the meeting of the advisory committee

of the Northwest Electric Light and Power Association, held in Seattle July 15 to 16, gave a brief report of the meeting and stated that a more complete report would be submitted later.

Mr. Boring, of the Pacific States Electric Company, called attention of the meeting to the evident lack of cooperation between the Portland and out-of-town members of the association.

Mr. McMicken of the Portland Railway Light & Power Company outlined a plan of cooperation between the architects, builders and contractors and dealers on the convenience outlet idea.

Considerable discussion was held on the matter of trade classification and Mr. Boring remarked that in his opinion there was a big field for the contractor-dealer in office buildings, theaters and hotels which was not being properly taken care of. It was decided that the second meeting in August be devoted to the subject of jobbers trade classification.

BUILDERS OF THE WEST — LXXXIII



JOHN STEPHEN MCGROARTY

From the Spanish architecture of its homes to the outdoor breadth of the spirit which builds its empires, a consecutive thread of color runs through the development of the West which traces its way back to the color and romance of its early history. To John Steven McGroarty, author of the Mission Play, who has interpreted for all time the spirit and glory of the Spanish Pacific, this issue of the Journal of Electricity is affectionately dedicated.

THE SAN FRANCISCO ELECTRICAL DEVELOPMENT LEAGUE'S TRIP TO HETCH HETCHY



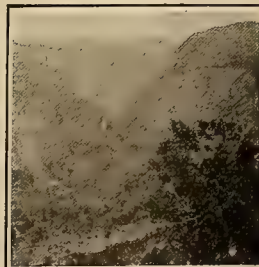
After breakfast the party proceeded to Priest portal where they climbed into ore cars and—



Went into the west end of the eighteen-mile tunnel, inspected it and—



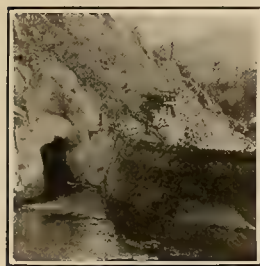
Proceeded to Big Creek, where they dropped some 400 feet down to inspect another face. And—



After lunch rode along enjoying the scenery until they reached—



Damsite where they went down to inspect the work on the dam and—



The diversion dam and tunnel. Then after a good night's sleep proceeded to visit the power house at—



Moccasin Creek. Before going on the tramway the bunch felt fine, but—



"Sing Voyer" didn't care for the drop and lost all interest until they inspected the—



Power house where he recognized a few name plates. And one and all gave their heartiest thanks to—



A. J. Cleary, assistant chief engineer, city of San Francisco, the chief guide on the trip.

Electrical Day at Los Angeles Ad Club

Under the guidance of K. E. Van Kuran, local manager for the Westinghouse Company, a splendid program was given before the Los Angeles Ad Club on July 27th.

H. B. Titcomb, vice-president of the Pacific Electric Railway, was the principal speaker, taking for his subject "How Traffic Congestion Can Be Permanently Relieved with the Least Cost to the Public." Mr. Titcomb explained the proposed plan for a joint passenger station and the rearrangement of tracks so that grade crossings might be eliminated. This was supplemented with a discussion of the possibilities of reducing running time to interurban cities by means of tunnels and elevated tracks.

Following Mr. Titcomb, four-minute talks were given on "Hydroelectric Development" by A. H. Lekliden, electrical engineer on the Southern California Edison staff; "The Relation of Hydroelectric Development to Growth of Our Community," by Carl M. Heintz of the Westinghouse Company, and "A Lesson From Electrical Development," by A. Carman Smith, a local advertising man.

The meeting closed with the showing of the moving picture "That Fairy in the Snowflake," which was presented at the Pasadena convention.

Pan-Pacific Scientific Congress

The Pan-Pacific Scientific Congress is in session from August 2nd to August 20th in Honolulu. The Chicago Chapter of the American Association of Engineers will be represented by Miss Florence King, a consulting engineer of Chicago. She bears the distinction of being the only woman member of the A. A. E. having a certified engineer's grade.

San Francisco Chapter, A. A. of E.

The August meeting of the San Francisco Chapter of the American Association of Engineers was addressed by Walter B. Cole, manager of the Marchant Calculating Machine Company and president of the Oakland Chamber of Commerce. Mr. Cole's address was on "The Relation of the Chapter to Civic Organizations" and proved to be of great interest to the members of the chapter.

Combination Code for State of California

At a recent conference between the committees representing the California State Association of Electrical Contractors and Dealers, the Electrical Supply Jobbers' Association of the Pacific Coast, the N. E. L. A. Pacific Division, and the Manufacturers' Safety Association of California, a full discussion of the proposed new code now being formulated by the Industrial Accident Commission took place. This discussion brought out the viewpoint of all present and at its conclusion it was unanimously agreed, that the interest of the public and the necessities of the electrical industry would best be served by action along the lines set forth in the following resolution:

"Resolved: We hereby recommend the uniting of the National Electrical Code (commonly known as the Fire Code) with the Electrical Utilization Safety Orders (commonly known as the Safety Code) into a Combination Code to be administered and enforced by the Industrial Accident Commission of the State of California, in so far as its jurisdiction may apply, provided:—

"First, That the National Electrical Code, not merely parts or revisions thereof, be incorporated in the proposed code, with the Commission having power to make mandatory any of the recommendations in said National Electrical Code; and that the proposed code shall be revised in keeping with the periodical revision of the National Electrical Code.

"Second, That the proposed code directly recognizes the labels issued by the Underwriters' Laboratories, both fire and accident, thereby eliminating the necessity of duplicate laboratory tests and approval in this state, all in accordance with par. 5 of the resolution adopted by the General Committee on Code Revision, bearing date of Sept. 22, 1919.

"Third, That in combining the two codes, the Commission adopt a new form which permits the grouping of all rules relating to a specific subject under the title of that subject; also that the subject titles relate to the classification of the installations; but this arrangement shall be so carried out as to definitely preserve the language and identity of the Fire Code rules as distinguished from the Safety Orders.

"Resolved Further: That the respective representatives of the four organizations, now serving on the Advisory Committee, cooperating with the Industrial Accident Commission in the formulation of the new code, be instructed to govern themselves in accordance with the recommendations set forth in the foregoing resolution."

Vancouver to Have Cooperative Campaign

Vancouver, B. C., is planning an Electrical Cooperative Association which had its conception at a dinner given last month by George Kidd, general manager of the British Columbia Electric Railway to representatives of the electrical industry in Vancouver. Committees were formed, a temporary organization set up, and arrangements made for a meeting in the near future to which all members of the electrical

industry in Vancouver will be invited to form a permanent organization.

Those present at the meeting were: W. G. Murrin, assistant general manager, B. C. Electric Railway Company; E. E. Walker, sales manager, B. C. Electric Railway Company; R. F. Hayward, general manager, Western Power Company of Canada, and James Lightbody, publicity manager, B. C. Electric Railway Company, representing the central stations. The manufacturers were represented by J. R. Read, local manager of the Canadian Westinghouse Company, and H. Pim, local manager of the Canadian General Electric Company; J. F. Little, local manager of the Northern Electric Company, and W. C. Mainwaring, local sales manager of the Northern Electric Company. The jobbers were represented by F. P. Cope and E. B. Horsman, and the contractor-dealers were represented by E. Brettrell, S. E. Jarvis, and W. W. Fraser.

N. E. L. A. Executive Committee

In outlining the work of the N. E. L. A. for the coming year at the first meeting of the National Executive Committee at Association headquarters, President Insull made several important committee changes. The work of the following national standing committees was placed under the direction of the Public Relations Section: Accident Prevention, Company Employes' Organizations, Membership, Cooperation within the Industry, Public Information, Service, and Relations with Educational Institutions.

In continuing the work of the Committee on Electrical Resources of the Nation, the scope of activities of the committee was changed from a post-war basis to a peace basis, the committee being directed to estimate and summarize the total demand for electrical energy during the years of 1920-22 inclusive, and the means at hand for supplying same; and also to estimate the increase in capital expenditures necessary to provide the necessary capacity to take care of the demand, and to analyze the relative effectiveness of private and public ownership.

The public policy of the electrical industry being of paramount importance in association work this year, S. Z. Mitchell, president of the Electric Bond and Share Company, was tendered and accepted the chairmanship of the Public Policy Committee.

The Wiring Committee, formerly under the Commercial Section, was made a national standing committee, with R. S. Hale, of the Edison Electric Illuminating Company of Boston, chairman. The Technical and Commercial Sections will each elect a vice-chairman of the committee, these three appointing the other members of the committee.

Other committees and the chairmen appointed are: Rate Research, Alex Dow, The Detroit Edison Company; Constitution and By-Laws,

W. C. L. Eglin, The Philadelphia Electric Company; Membership, Walter Neumiller, The New York Edison Company; Electrical Resources of the Nation, M. S. Sloan, Brooklyn Edison Company, Inc.; Doherty and Billings Prizes, A. S. Loizeau, Consolidated Gas, Electric Light and Power Company, Baltimore; Electrification of Steam Railroads, F. M. Kerr, Montana Power Company, Butte; Finance, Joseph B. McCall, The Philadelphia Electric Company; Lamp, Frank W. Smith, The United Electric Light and Power Company, New York; Water Power Development, Franklin T. Griffith, Portland Railway, Light and Power Company.

San Francisco Chapter, A. A. of E.

C. D. Marx, head of the civil engineering department of Stanford University, addressed the American Association of Engineers recently on "The Proposed Department of Public Works." The speaker has advocated the transfer of the jurisdiction over river and harbor improvements from the military engineers to civilian engineers for the past thirty-six years and is now leading the California engineers in the fight to secure passage of the Jones Reavis bill in Congress.

The speaker discussed the new bill in detail and told how the engineering works of our governments were spread over five departments and many bureaus causing needless duplication of effort and wasteful expenditure of public funds. The new bill proposes the change in name of the Interior Department to the Department of Public Works and the removal from the department of all matters pertaining to education and care of public wards, which are now sandwiched in with purely engineering works.

The Chamber of Commerce of the United States secured a majority vote among its members but due to a shortage in the total vote cast, it cannot officially endorse the bill.

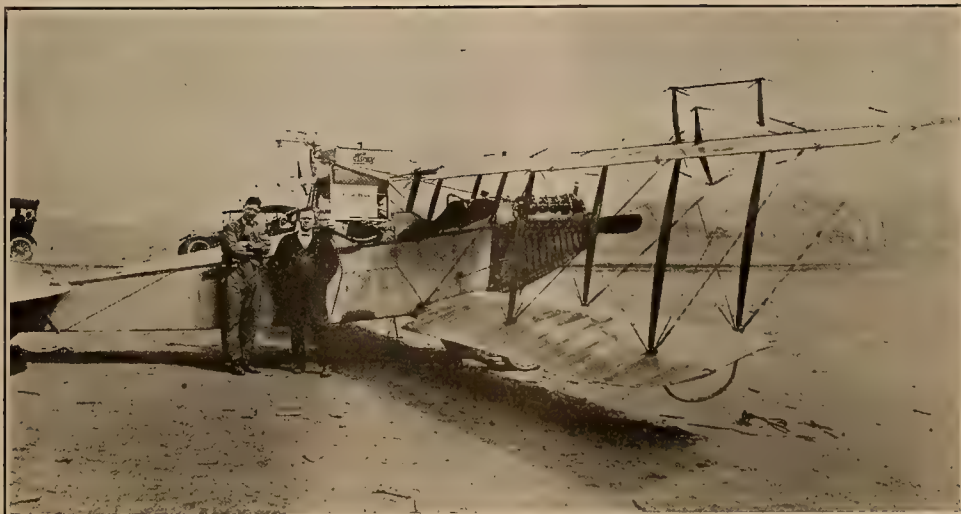
It will be recalled that the Taft plan for reorganization of all departments failed of passage due to the magnitude of the problem. Franklin K. Lane recommends the bill and Herbert Hoover will lend his influence in its passage. It is certain that over 100,000 engineers will work actively in support of the measure in the interest of governmental efficiency. Friends of the measure may secure copies of the bill and literature from the Department of Public Works Association, New York, or from Professor Marx.

Water Power Commission Meets

Applications coming in large part from the West to the office of the federal water power commission for permits and licenses to develop water power now aggregate 2,000,000 horsepower, according to O. C. Merrill, executive secretary of the commission. The commission, created under the water power bill recently passed by Congress and composed of the Secretaries of War, Interior and Agriculture, held its first meeting recently, without waiting longer for the return of Secretary John B. Payne. The anxious desire of applicants for some definite action hastened the meeting. Secretary Baker and Secretary Meredith were present.

DELIVERING BY AIRPLANE

This picture is of the airship which the Linker Electric Company of LaCrosse, Wis., used in delivery a favored Thor Washing Machine during a recent campaign. The delivery was made to Onalaska, about eight and a half miles away, in twelve minutes after the take-off. Needless to say this stunt stimulated the campaign sales to a great extent and secured a great many future prospects for the company.



HAPPENINGS IN THE INDUSTRY

PLANS FOR TUNNEL CONSTRUCTION

In a letter to the city council of Seattle J. D. Ross asserted that the construction of a tunnel at Cedar Lake to increase the output of the city's Cedar Falls hydro-electric power plant would permit the City Light Department to reduce its light and power rates to their original figure—about 20 per cent—within a year, pay off all outstanding warrants, and avert the possibility of a "shutdown of many Seattle factories and the darkening of streets and thousands of homes."

Mr. Ross urged immediate action on the tunnel project, and also asked the council to proceed with the development of the Skagit River power project with all possible speed, declaring that the city plants are now operating at a cost of four or five times the cost of Skagit power.

He opposed the substitution of coal for fuel oil at the Lake Union auxiliary power plant, declaring that the installation of coal burners and the purchase of the first year's supply of coal would cost the city \$1,440,000, while the Cedar River tunnel project would cost but \$1,100,000, and would then become a permanent asset. The \$1,000,000 worth of coal, on the other hand, he said, would be a dead loss and would soon have to be repeated.

Mr. Ross' plan is to construct a tunnel 8,500 feet long through solid rock from the masonry dam on Cedar River, tapping Cedar Lake for hydroelectric power, which he believes will increase the output of the Cedar Falls power plant from its present maximum of 15,000 horsepower during the winter months to 50,000 horsepower.

Mayor Hugh M. Caldwell has asked the Council to appoint a commission to investigate the project, and City Engineer A. H. Dimock has requested the appropriation of \$5,000 for a similar purpose. The project has also been endorsed by the Greater Seattle Bureau of the Chamber of Commerce, which has also recommended the appointment of a commission.

DISPLAY AT THE CALIFORNIA STATE FAIR

A bulletin from the California Tractor and Implement Association announced that all the power farming machinery interests are to concentrate their exhibits in one huge display this year at the California State Fair which is to be held at Sacramento, from the fourth to the eleventh of September. This display will be under the auspices of the California Tractor and Implement Association.

INCREASE IN OIL OUTPUT

The production of crude oil during the month of May averaged 278,343 bbls. per day, or an increase of 3,446 bbls. as compared with April's output. However, as the May shipments were 295,100 bbls. per day, an increase of 4,677 bbls. daily as compared with April, the stocks were decreased 520,087 bbls. during the month. Fifty-seven new wells were completed during May, with an initial daily production of 8,795 bbls. The total shipments from the field for the month of May were over 9,000,000 bbls.

NEW INSTALLATION IN PORTLAND

Construction work is about fifty per cent completed on the installation of a 500 hp. Stirling, three-phase boiler at the Station "L" steam plant of the Portland (Ore.) Railway Light & Power Company. This boiler will burn "hog fuel," or saw mill refuse normally, but is being equipped to burn oil also, and will serve as an auxiliary and provide additional boiler capacity for future developments.

INCREASED SAILINGS BETWEEN PACIFIC COAST AND THE ORIENT

Considerable increase in passenger traffic and commerce between Pacific Coast ports and the Orient, by the end of this year, and perhaps earlier is forecast in the recent allocation to steamship companies on this Coast of fifteen new passenger liners.

All fifteen vessels are now under construction in the East, and the work of finishing them is being pushed with all reasonable speed.

They will each have a speed of 17 knots, and a dead-weight tonnage of 12,000.

The Pacific Mail Steamship Company, which has been allotted five of the vessels, said its share will enable the company to handle four times its present passenger traffic to the Far East every month. Further these five new vessels will make possible sailings from San Francisco every two weeks instead of the present monthly sailings.

According to a statement issued yesterday by officials of the same company at Seattle, the company will establish a new and direct line from this coast to Vladivostok and Shanghai without touching at Japanese ports—a route, it is said, for which there is an insistent demand, due to the rapidly increasing volume of intercourse between the United States and China.

Five of these fifteen ships have been allocated to the Pacific Mail Company, five to the Pacific Mail Company, and five to the Matson Navigation Company.

LICENSING OF OREGON ENGINEERS

Since the Oregon State Licensing Law for Engineers has been in effect 1,160 licenses have been issued under the following classifications:

805 civil engineers; 178 mechanical engineers; 157 hydraulic engineers; 119 electrical engineers; 64 mining engineers; 50 structural engineers; 36 metallurgical engineers; 14 chemical engineers; 12 logging engineers; 11 naval engineers; 2 fire protection engineers.

Since July 1, 1920, licenses are being issued after examination only, prior to that time they were issued upon application.

SOUTHERN SIERRAS EMPLOYEES' MEETING

Over one hundred employees of the Southern Sierras Power Company attended a meeting held in Riverside on July 23 to discuss the development plans of that company.

Chief Engineer C. O. Poole delivered an interesting lecture, illustrated with lantern slides, in which he explained the purpose of the company's generating plants, transmission lines and distribution system. The pictures included scenes at Rhinedollar Lake, lumbering operations, tunneling and dam construction.

Music was furnished by the Southern Sierras orchestra, the meeting being in charge of assistant treasurer, A. S. Cooper.

RUSSIAN AND AMERICAN ENGINEERING SOCIETIES

In an address delivered before a recent joint meeting of the founder societies held for the purpose of discussing the value of a liaison between the engineering societies of Russia and America, N. A. Stephanoff, president of the Russian Society in America, brought out some interesting facts concerning Russia's engineering development. He said in part:

"Every specialty of engineers used to have its own societies, grouping all its members, as the government of the old regime was strongly opposed to any scheme of one large union, which would have united all the engineers of Russia. However, within two months of that government's overthrow, one All-Russian Engineers' Union was formed, which admitted in its ranks, not only the graduate engineers but also the practical, regardless of political opinion. This association numbers about 60,000 members.

"The Russian engineers have always been deprived of their initiative by the government * * * and it is only during the fifteen years which preceded the war that they really began to come into their own and occupy the first place in their own country. * * * As to the psychological characteristics of the Russian engineer, first comes the absence of selfish aims in his work. I can best illustrate this by mentioning that during my 22 years of experience in Russia, I never heard of one industrial engineer having made money."

In speaking of Russian achievements in engineering W. F. Dickson, director of the Russian Singer Society, said:

"In the matter of bridge building some very fine work has been accomplished. The suspension bridge across the Dnieper at Kiev, the bridges over the Volga at Syzran and Yaroslavl, the Palace Bridge over the Neva at Petrograd, all rank among similar structures in this and other countries.

"The great Siberian Railway stretching from the Gulf of Finland to the Pacific Ocean and linking together Petrograd and Vladivostok, cities five thousand miles apart, can be compared favorably with trans-continental lines in America. The skill displayed by the Russian engineers in spanning the wide Siberian rivers and in piercing forty-two tunnels through the rocky cliffs bordering the southern shores of Lake Baikal, situated about half way across Siberia, is something engineers of any nationality might be proud of."

PACIFIC GAS & ELECTRIC COMPANY TO SELL MORE STOCK

The Pacific Gas & Electric Company has been authorized by the Railroad Commission to issue and sell one million dollars of its first preferred capital stock at not less than \$80 a share. In the application to the Railroad Commission for permission to sell this stock, A. F. Hockenbeamer, vice-president and treasurer of the company, stated that they would need approximately twenty million dollars during the remainder of 1920 and 1921 to proceed with the contemplated construction work. The proceeds of the sale of this new block of stock is held subject to the orders of the Commission.

POSITIONS FOR ENGINEERS

The United States Civil Service Commission announces open competitive examinations for the positions of engineer at \$2,400, or over per year, of assistant engineer at \$1,800 to \$2,340 per year and of junior engineer at \$1,440 to \$1,740 per year. Vacancies in the Water Resources Branch of the Geological Survey at these salaries will be filled by these examinations.

On account of the needs of the service, papers will be rated promptly and certification made as the needs of the service require. In the absence of further notice, applications for these examinations will be received by the Commission at Washington, D. C., until the hour of closing business on December 1, 1920. If sufficient eligibles are obtained, the receipt of applications may be closed before that date, of which due notice will be given.

Appointees will generally be assigned to the work of gauging streams and the study and investigations of water supply, water utilization, and power in the United States. The work will consist of field investigations and the writing and review of the resulting reports. The field of investigation may be in any part of the United States.

The rating of applicants for positions as assistant engineer will be half on general and technical education and training and half on professional experience. Those applying for positions as junior engineer will be considered according to the following rating:

	Weights
1. Surveying	10
2. Mathematics	20
3. General hydraulics	30
4. Water-power engineering	10
5. River hydraulics (under the subject of river hydraulics, including stream gauging, in the statement of ratings the applicant must indicate the course or courses in which this subject was studied)	15
6. Training and experience	15
Total.....	100

SIXTY MILLION DOLLAR SUIT OVER WATER RIGHTS

The town of Antioch and the farmers of the delta regions of the Sacramento river are endeavoring to secure an injunction against the rice growers of the upper regions of the river to prohibit them from taking excessive amounts of water from the river for irrigation purposes. The plaintiffs declare that the excessive use of water in the irrigation of rice fields has brought the level of the river down to such an extent that the salt water of Suisun Bay is backing up in the river, rendering the waters unfit for domestic or agricultural uses. The defendants in the action have declared that if they are prohibited from further irrigation of their fields it will mean a loss to them of \$60,000,000 as their entire crop of rice would be spoiled.

EXTENSION COURSE IN ELECTRICITY

A series of courses in electricity given under the Extension Department of the University of California are to be opened on the evening of August the seventeenth, at the Oakland Polytechnic High School which is located on Frederick near First Street, Oakland. These courses will be given under the direction of A. L. Jordan.

A beginning and an advanced course will be given so that students may be placed at any time in a class suited to their needs. Classes begin at 7:15 p.m.



This extremely attractive booth belonging to the Shasta Electric Works was a feature at the Farm Bureau Fair which took place a short time ago at Anderson, California. As can be seen, all of the electrical appliances which go to make up a modern electrical home are displayed here to advantage.

APPLICATION TO MORTGAGE BUILDINGS

To secure the funds estimated to be necessary to complete its hydroelectric development known as the Caribou plant on the North Fork of the Feather River and to construct a steel tower transmission line from the plant to Valona in Contra Costa County, the Great Western Power Company of California has applied to the Railroad Commission for authority to mortgage its entire holdings to secure a bond issue of \$5,000,000. The Commission is asked to approve the company's plan to issue and sell \$3,500,000 of the bonds to E. H. Rollins and Sons at 93 and accrued interest.

In April, 1919, the Commission authorized the Great Western to issue and sell \$6,000,000 of bonds and \$1,500,000 of preferred stock. Last May the company was authorized by the Commission to issue and sell an additional \$1,500,000 of its preferred stock.

CO-OPERATION BETWEEN THE AGRICULTURIST AND THE ELECTRICAL INDUSTRY

A Letter to the Editor

Sir:

As I am conversant with the demands for agricultural power in both the central and southern sections of the state, and was interested in the development of the small motor-driven unit and storage basin—the answer to financial problems of the rancher and the operating difficulties of the power corporation—I should like to make a plea for cooperation between agriculturist and utility and the adoption of a permanent instead of a transitory solution of the present power situation.

I refer especially to night irrigation, the alternate operation of pumping plants running fifteen days or less per month, and the limiting of plant operation to non-peak hours—8 p.m. to 6 a.m., as proposed in the March first issue of the Journal of Electricity.

Undoubtedly the precipitation on the West Coast since 1917 has been below normal, and conditions now obtaining are acute, the ever-increasing demand for electrical power being now in excess of the quantity of energy generated in periods of drought. But it is also a self-evident truth that in the years prior to 1915, comparatively little attention was given to the character of the load connected to the distribution system of the utilities. Flowing wells were pumped in an effort to secure a greater irrigating head. Twelve and sixteen-inch holes were drilled to unnecessary depths, and equipped with pumps far in excess of the capacity of the wells. Large heads of water were desired for only one hundred or two hundred hours out of each seven hundred and twenty-four hours. Neither the rancher nor the average public service corporation gave consideration to the water rate, to the actual use of the water, or to the most efficient method of pumping water, (a) with a minimum lowering of the water level in the well or, (b) at a fair and equitable cost. The result was not only pernicious to the rancher, but placed upon the power corporations an unnecessary demand for electric power.

The remedy, however, is not in the promulgation of emergency measures such as night irrigation, but in the utilization by the rancher of such pumping units as will deliver over a given period of seven hundred and twenty hours the same quantity of water or more than is now pumped in periods ranging from one to two hundred hours. Such a scheme, permanent in its character, will not only be in harmony with aggressive and comprehensive plans which may be discussed by the Department of Agriculture and for the conservation of water, but will permit of the systematic operation of generating units feeding an interconnected system at a minimum fuel consumption—coal, oil, or white coal.

The irrigation load is the result of the large inefficient motor-driven pumping plants, developed without reference to

any normal percentage of growth. Acreage planted to alfalfa and yielding eight to twelve tons to the acre and groves supplying citrus fruits, were the mecca for many "home-seekers" as well as those who sought the ownership of a California country home. Each section purchased demanded a pumping plant, and too often the plant of a neighbor was duplicated without inquiry as to its efficiency or water strata tapped. Lessee succeeded owner, and only after useless and expensive changes in pumps did experience become a teacher. The large unit was discarded, and the small direct-connected pump, installed in a pit, or the deep well Pomona head delivering water to an oil-lined reservoir or storage basin, proved the answer to perplexing problems of ranch management and financing. Utility management cooperated with the rancher to solve his problem. Will the same management direct its efforts toward the elimination of many more large and inefficient pumping plants—an enduring solution to the problem now uppermost in agricultural circles—or will expensive temporary emergency methods be pursued? Every dollar expended now in remodeling agricultural pumping plants not only improves load and power factor, but is a decisive step in the interests of conservation of fuel and the effective utilization of water, and is a potent factor in the reconstructive program necessary for the welfare of the individual, the growth of the community and for the increase in productiveness of the commonwealth.

R. B. MATEER,
Philadelphia Electric Co., Pa.

TRADE NOTES

Recent Appointments —

The Booth Electric Furnace Company, Chicago, report a number of additions to their sales and engineering staff. Mr. B. G. Tarkington, formerly industrial heating engineer with Hodenpyl-Hardy Company, Jackson, Mich., is located at their Chicago office in charge of district sales.

The Buckeye Products Company, Cincinnati, Ohio, who have charge of sales in the Cincinnati territory, have placed Mr. D. E. Carpenter, formerly of the Detroit office of the Westinghouse Electric & Manufacturing Company, in charge of sales of Booth furnaces in that district. Among the foreign offices recently opened is one for Australasia in charge of Mr. Bartholomew Bannon, at Sydney.

New Iowa Representative —

J. K. Alline, formerly of the Electric Appliance Company of Chicago, Illinois, is now Iowa representative for the Packard Electric Company of Warren, Ohio, manufacturers of transformers and automotive cable.

Change in Plant Products —

After completing their war contracts, the Toledo Screw Products Co. converted their plant to manufacture the Air-Way Electric Cleaner. Production now exceeds 250 cleaners a day and the facilities are being increased to permit a daily production of 1000.

New Establishment in Colorado —

An enterprise known as the Western Slope Electric Company has been established in Telluride, Colorado. This company announces its intention of placing machinery, re-winding motors, doing house wiring, and other types of electric work. H. H. Ford, formerly of Colorado Springs, is secretary and manager of the new enterprise.

New President Elected —

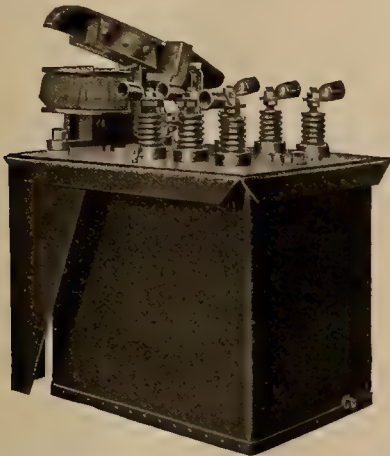
At a special meeting of the Board of Directors of SKF Industries, Inc., New York City, the resignation of B. G. Prytz, as president, has been accepted, Mr. Prytz having been elected managing director of the parent company, with headquarters at Gothenburg, Sweden. At the same meeting F. B. Kirkbride, vice-president since the organization of the company, was elected president to succeed Mr. Prytz.

LATEST IN EVERYTHING ELECTRICAL

(The new oil immersed magnetic contactor which is described and illustrated on this page is of interest because the reliability of operation is greatly increased through the use of a clapper type magnet and armature. An unusually helpful handbook for electricians and one on Controllers for electric motors are reviewed in the column on Books and Bulletins.—The Editor.)

OIL IMMERSSED MAGNETIC CONTACTOR

The frame of this contactor, which is of heavy sheet iron, is arranged for wall or switchboard mounting, and carries two cast iron supports with two insulated shafts carrying the contacts. Copper leaf brush contacts are saved from all wear due to breaking the circuit because auxiliary arcing contacts are provided for this purpose. Leads from the con-



New C-H oil immersed magnetic contactor operated by a clapper type magnet and armature which increases reliability of operation over the solenoid and plunger type.

tacts connect with suitable terminals extending through high tension insulators mounted on the top of the frame. The armature is firmly pivoted to the frame, and is connected by a rod to an arm of the shaft carrying the moving contacts.



Oil tank removed showing contacts and arcing shields. By breaking in a horizontal plane, the arcs do not damage other parts.

The attraction of the armature against the face of the magnet rotates the shaft and closes the switch, which is normally held open by the weight of the moving parts.

A good head of oil is maintained over the contacts by providing a sheet metal tank of ample capacity, and as the contacts are situated above the operating shaft, they are away from any sediment which might accumulate in the bottom of the tank. The arc is broken at the contacts in a horizontal direction and therefore rises to the point of rupture without burning other parts. Transit shields prevent arcing across adjacent poles.

This new oil-immersed switch may be arranged to have two contactors act as a reversing switch, in which case they are mounted side by side, so when one switch is closed the nose on the armature interferes with the movement of the armature of the other contactor, thereby preventing the closing of the other switch, which would short-circuit the line.

Book and Bulletins

Electrician's Handy Book

By T. O. Conor Sloane; 825 pp., 4½ x 6½; 600 engravings. Published by The Norman W. Henley Publishing Company, New York City.

A revised and enlarged edition of this book has just been issued. It covers in the most practical manner, the entire field of electricity. It begins with the A, B, C's of the subject and takes up in turn motors, dynamos, switchboards, electric railways, various types of arc lamps, electric furnaces, and many other advanced branches of the science.

The author of this book deserves credit for having covered this extensive subject in a complete yet most practical and readable manner.

Controllers for Electric Motors

By Henry Duvall James, B.S., M.E. 351 pp., 5½ x 8; 259 illustrations. Published by D. Van Nostrand Company, 25 Park Place, New York City.

The object of this book is to bring the Industrial Controller Art to the attention of technical students, operating engineers, purchasers and users of electrical apparatus so as to give them a general idea of Industrial Controllers and their principles of operation.

A great number of illustrations are used, the majority of which have been selected for the purpose of showing principles of operations. Most of the diagrams used are considerably simplified for the purpose of clearness. The processes and methods of operation are described in some detail in the section on applications.

The Motor Book

The Dalley Electric Company of St. Louis, Missouri, have published an attractive booklet which gives an account of the motor production which is taking place at the company's plant. Descriptions and illustrations of the various types of motors are followed by a page of shop facts and an installation guide.

Charts of Heat Losses

A series of graphic charts has been published recently by the Celite Products Company. These are an adaptation of the coordinate calculating chart, based on D'Ocane's method of isopleth, to the computation of heat losses and temperature gradients. They make it possible to obtain accurate results easily and quickly and eliminate the tedious and involved calculations formerly required. A pamphlet which includes a reproduction of some of these charts and directions for use of those which determine heat flow through furnace walls, is being distributed by the company.

NEW ELECTRICAL DEVELOPMENT

(First steps in the construction of a diversion dam and an important court decision which has to do with the Skagit River project, are among items from the Northwest. The Pacific Central district reports the rebuilding of a high voltage line in one part of California and the erection of a large outdoor substation in another, while the Southwest reports the construction of the largest service station in the world, as well as plans for establishing a 22,000-hp. power plant in New Mexico. An enlarged irrigation district demanding a supply of electric power and the extension of a cities lighting system are among Intermountain items.—The Editor.)

THE PACIFIC NORTHWEST

ABERDEEN, WASH.—Oakville residents voted Tuesday, August 10, on issuance of bonds for \$20,000 for the purchase of the Oakville Electric Light & Power Company plant at that place. The election was held in the council rooms of the town hall.

PORTLAND, ORE.—The Pacific Telephone & Telegraph Company has filed with the city building inspector plans for the new exchange it proposes to construct at 771 Stanton Street, in Irvington. Preliminary estimates place the cost of construction at \$123,691.

SPOKANE, WASH.—Favorable conditions for a new moving picture theater to cost at least \$750,000 were found in Spokane by Frederick Frisk, manager of the United States Exchange of San Francisco. Mr. Frisk will return in a few months to further plans for the theater building.

PORTLAND, ORE.—Lightning arresters are to be installed on the 11,000-volt circuit supplying power to Municipal Terminal No. 4, according to a decision of the Public Dock Commission. This action was decided upon following the recent electric storm which did considerable damage to wiring and equipment at the terminal.

LLWACO, WASH.—Llwaco faces the necessity of being without light, power or water for an indefinite period as the result of a fire which completely destroyed the plant of the North Shore Light & Power Company. The loss of E. F. Wood, the owner of the light and power company, has not been estimated, and no plans have been made for rebuilding the plant.

DALLAS, ORE.—The Mountain States Power Company has about completed the installation of a 750-kw. generator to be driven by a Curtis steam turbine. Hog fuel will be burned. This company has also contracted with the Willamette Valley Lumber Company of Dallas to supply them with 1600 hp. of electric energy for their new saw mill which will be electrically operated throughout.

PORTLAND, ORE.—A contract has been awarded for the construction of the extension of the St. Johns line of the Portland Railway Light & Power Company to Municipal Terminal No. 4. The contractor will perform all of the work on the roadbed, furnish the ties, lay the track and repair the paving. The work on the extension will be started at once and rushed to completion.

OLYMPIA, WASH.—A Contract for digging and dredging of the main line ditches for the drainage system in the Black Lake territory, known as Consolidated Drainage District No. 101, was let by the board of county commissioners to E. J. Cheatham and Sons of Spokane, and work on the big project will be started as soon as the contractor can get his equipment on the ground.

SEATTLE, WASH.—That Supt. J. D. Ross' plan to tap Cedar Lake with a tunnel 8,500 ft. long leading to the city light department's hydroelectric plant on Cedar River is entirely feasible was stated in a recent communication to the city council by City Engineer A. H. Dimock, who recommended an appropriation of \$5,000 for test borings and surveys. Mr. Dimock's report was received by the council utilities committee and was ordered placed on file.

BRIGHTWOOD, ORE.—The Brightwood Company, through W. C. Borthwick, of Portland, has applied to the State Engineer for a permit to appropriate 10 second feet of the water of Little Sandy River, tributary to Bull Run River, for power, which it is stated will be devoted to general local use. The company will construct a timber crib dam, timber headgate, and a canal or flume $1\frac{1}{4}$ miles long, at an estimated cost of \$5,000.

PORTLAND, ORE.—Plans for the new Southern Pacific electric passenger station, which is to occupy the site of the Lyric Theater at Fourth and Stark Streets, are being prepared by J. H. Christie of San Francisco, architect for the Southern Pacific Company. Reconstruction of the building will require several months.

SPRINGFIELD, ORE.—The Mountain States Power Company, who operate the lighting plant in this place, are installing a 600-hp. Stirling boiler unit, to provide additional steam for electric generation.

GRANT'S PASS, ORE.—First construction has started on the 500-ft. concrete diversion dam at Savage Rapids for the big gravity project of the Grants Pass irrigation district. Work will be prosecuted now under high pressure, with day and night crews working the equipment on hand 24 hours a day in order to accomplish results during the low stage of the river. The excavation for the power house on the north bank is already 50 per cent completed, and by the time the north half of the river bed is cleaned off, will be complete.

SEATTLE, WASH.—A letter from City Superintendent of Lighting Ross to the city council calls particular attention to several salient points as effecting the generating of electric current for the city's use and emphasizes what Superintendent Ross considers as serious drawbacks to using either powdered coal, hogged fuel or fuel oil to generate power. The changing of the equipment of the Lake Union steam plant so that coal could be used instead of oil, as has been outlined to the council, would cost \$640,000 and this expense, according to Superintendent Ross, would be a dead loss when the Skagit plant is eventually in operation.

BELLINGHAM, WASH.—In an order entered in the superior court by Judge Hardin the city of Seattle wins a clear-cut decision in the case brought by Whatcom county and Skagit county property owners seeking to prevent Seattle from developing its hydroelectric project on the Upper Skagit River. Judge Hardin directed counsel for the city of Seattle to draw an order covering his verbal opinion, which is to be signed by defense counsel and submitted to the court for approval. The action is preliminary to condemnation proceedings contemplated by Seattle for the building of a railroad and power project. It is probable that the condemnation case will come before the court at the September jury terms.

SEATTLE, WASH.—Every electrical contractor in Seattle will be required to obtain a license from the city, and those who have been in the electrical contracting business for less than two years, including new applicants, will be required to pass an examination, if a proposed revision of the city electrical code is adopted by the city council. The new code has been drafted by a committee appointed by the city building depart-

ment, consisting of representatives of the Building Owners and Managers' Association, the architects, master builders, electrical contractors and electrical journeymen, and is now in the hands of Corporation Counsel Walter F. Meier for an opinion as to its validity. It provides for appointment of a board of examiners before whom contractors who have been practicing in Seattle less than two years will be required to appear before they are granted a city license. Contractors who have been in the business more than two years need not be examined, according to the provision of the code, but they must apply for permits within three months after its adoption. New applicants are required to pass an examination.

THE PACIFIC CENTRAL DISTRICT

SCOTIA, CAL.—The Pacific Lumber Company's mill "A" at Scotia is to be operated by electricity. A 2000-watt turbine will be installed.

MARYSVILLE, CAL.—The Pacific Gas & Electric Company has paid the city of Marysville \$538.08 in settlement for its franchise for the year 1920. This represents 3 per cent of the 40 per cent gross receipts from the fuel gas service maintained by the company during that period. Figures show the Pacific Gas & Electric Company realized \$44,840.

ALAMEDA, CAL.—The Municipal Electric Light Company's net profit for the fiscal year of 1919-1920 amounted to \$71,000. This year's profit is nearly 50 per cent increase over the fiscal year of 1919, which was \$46,844. Because the city owns its plant the consumers were saved \$34,032 due to the low rates which they would not have had if it had been a privately-owned company.

SAN FRANCISCO, CAL.—Gross earnings of the Great Western Power system increased \$44,186 in May over the same month of last year, and net after taxes, \$29,801. The balance after accrued preferred dividend was \$2581. For twelve months ending with May, gross increase amounted to \$606,766, and net after taxes \$149,509. Balance for the period after accrued preferred dividend decreased \$105,294.

SAN FRANCISCO, CAL.—The Fair Oaks Electric Company, which sells electricity for light and power to the territory in the Fair Oaks irrigation district, including the village of Fair Oaks, in Sacramento county, have asked the Railroad Commission for authority to establish higher rates for electricity. The company's rates have not been changed in four years and it is now claimed that they are no longer remunerative.

SAN FRANCISCO, CAL.—To secure the funds estimated to be necessary to complete its hydroelectric development known as the Caribou plant on the North Fork of the Feather River, and to construct a steel tower transmission line from the plant to Valona in Contra Costa county, the Great Western Power Company of California has applied to the Railroad Commission for authority to mortgage its entire holdings to secure a bond issue of \$5,000,000.

RICHMOND, CAL.—Consolidation of the lines of the power companies and street car company on a single set of iron poles, from which street lights will also be suspended, is proposed in

plans drawn by the Western States Gas & Power Company, with which the city is entering into a new contract for street lights. The city council has withheld approval of the contract until provision is made for an electrolier system for the business district.

NEVADA CITY, CAL.—The high voltage line of the Pacific Gas & Electric Company between the Colgate and Drum power houses is to be rebuilt during the next few months in order that the carrying capacity may be increased from 30,000 to 60,000 voltage. Materials are being assembled and crews organized for the work. The work is thirty miles in length, and the rebuilding is estimated to cost \$225,000. The work will not be completed before January 1.

STOCKTON, CAL.—According to estimates filed with the city council, Fred H. Tibbitts, consulting engineer, Alaska Commercial Building, San Francisco, the present value of the Pacific Gas & Electric Company's water plant is \$1,332,736. The city is contemplating the purchase of the system through a bond issue. Should the system be purchased and the recommendation of Engineer Tibbitts be accepted, the city will spend \$186,539 in extensions to districts not now served.

TEHACHAPI, CAL.—The town of Tehachapi, which sells and distributes electricity for both lighting and power purposes to consumers beyond its corporate limits, has applied to the Railroad Commission for authority to increase its charges for the service beyond the town limits. It is proposed to make the rate sufficiently high to take care of the surcharge of twenty-seven per cent collected by the Southern California Edison Company on its bills for electric energy sold to the town.

YUBA CITY, CAL.—Arrangements were made by the Sutter-Butte Canal Company to complete its system of canals in Sutter county in order that by the opening of next season the company will be in a position to serve 24,000 acres of land with water for irrigation. The greater portion of this area is rice land. The extensions will cost in the neighborhood of \$500,000, to be shared equally between the canal company and the land owners who will be benefited by the extension of the irrigation service.

OKDALE, CAL.—The State Water Commission has revised its ruling which threatened to hold up the contemplated building of the Melones reservoir. The commission which in a previous letter to the Oakdale irrigation district held that no storage permit could be issued unless the district owned the property—objection having been made by the Calaveras Copper Company—has in a second letter held that the district may by contract or agreement secure the reservoir site, ownership to be secured after the bonds are voted.

BAY POINT, CAL.—The Bay Point Light & Power Company has purchased the land at the foot of Bay View Avenue and the San Francisco-Sacramento Railroad tracks and will start immediately to erect a large outdoor power substation. The power company's present substation is located in the yards of the Coos Bay Lumber Company and will soon be inadequate for the size of transformers that are now needed. A large switching house is to be built, containing switchboards, oil switches, meter and other equipment necessary for the safe operation of the system.

SAN FRANCISCO, CAL.—The United Railroads of San Francisco must pay the surcharge on electric rates recently allowed the Pacific Gas & Electric Company by the Railroad Commission. The commission has refused a request from the United Railroads asking that the commission's order creating the surcharge be modified so as to exclude the transportation company from its terms. The request of the United Railroads was based on a contract for power it has with the Sierra and San Francisco Power Company, which company is now being operated by the Pacific Gas & Electric Company under lease. The

United Railroads claimed that to increase this rate would result in unjust discrimination against it. In its denial the commission holds that the claims of the United Railroads were given due consideration and that the surcharge is just and reasonable.

THE PACIFIC SOUTHWEST

SANTA FE, NEW MEX.—All bids on the \$148,000 bond issue for water, light and sewer at Clovis have been rejected.

ORANGE, CAL.—A contract has been awarded to the General Electric Company for furnishing a 50-hp. motor for the city water works.

BLYTHE, CAL.—Foundations have been laid for a new building to house the electric plant of the Southern Sierras Company. Two carloads of machinery have arrived.

PHOENIX, ARIZ.—Ford, Morgan and Company have been awarded the contract for the excavation of a 20-mile trench for a wood stave pipe line and also for back filling, at \$80,000.

OLINDA, CAL.—The Happy Valley irrigation district has shut down work on the Hoover tunnel. It is announced that this is due to dissatisfaction with the progress being made. This tunnel is to be 6500 feet long and is just about half completed.

TUCSON, ARIZ.—With the local loan of \$25,000 and volunteer free assistance of Tucson chapter of the American Association of Engineers, two new wells can be sunk and an ample supply of good water obtained for the city, it has been reported by a special committee of the chapter.

VAN NUYS, CAL.—Chief Engineer Jas. W. Reagan has offered the solution of financing the large reservoir planned for construction in the Pacoima Canyon. Three hundred thousand dollars have been allotted by Los Angeles for building a dam back of San Fernando and state funds will also be given for this purpose.

CASA GRANDE, ARIZ.—That construction of the diversion dam here is in sight is evidenced by the fact that advertisements calling for construction of the dam have appeared in California papers. The dam will be built of reinforced concrete and will be located a few miles north-east of Florence, near Price station and adjacent to the Arizona Eastern railroad tracks.

ALBUQUERQUE, NEW MEX.—Plans for the establishing of a power plant capable of developing 22,000 hp. at Elephant Butte dam are in progress. The approximate cost will be four million dollars and the electric power generated would be used on local electric transmission lines. The Stone and Webster Street Car Company of Boston and El Paso desire to lease the power plant from the Water Users' Association and would supply power to farmers.

LOS ANGELES, CAL.—The Western Electric Corporation will erect the largest service station in the world at 16th and Hope streets. The building is to be of brick, 150 by 155 ft. and two stories high. Construction work has already started. The first floor will be devoted to battery inspection, recharging, and sales room. The second floor will be devoted to the general offices. The ground floor is to be built so as to be entirely enclosed in glass. Work is being rushed on this new building and it is planned to move into the quarters some time early in November.

SAN BERNARDINO, CAL.—To meet the demand for increased electrical energy, the Southern Sierras Power Company has just completed the task of "stepping up" the voltage of its 240-mile line from Inyo county to the city of San Bernardino. The work represents an expenditure of \$250,000 and increases the horsepower from 25,000 to approximately 60,000 hp., or $2\frac{1}{4}$ times. It required a year to make the changes required, and the successful culmination of the enterprise has been most satisfactory to all concerned.

THE INTER-MOUNTAIN DISTRICT

RIRIE, IDA.—The town of Ririe has just celebrated the advent of electricity. The Utah Power & Light Company is now furnishing service to practically all of the business houses and part of the residential district, and more consumers will be added as soon as the necessary wiring is completed.

KIMBERLY, IDA.—An irrigation district is being organized in the Kimberly, Hansen and Murtaugh sections of Twin Falls and Cassia county, to irrigate 45,000 acres of dry lands in what is known as the Hansen-Butte project. It is proposed to put in a pumping plant on the Snake river near Murtaugh and generate electricity sufficient to run the pumps and also have electric power for the tract.

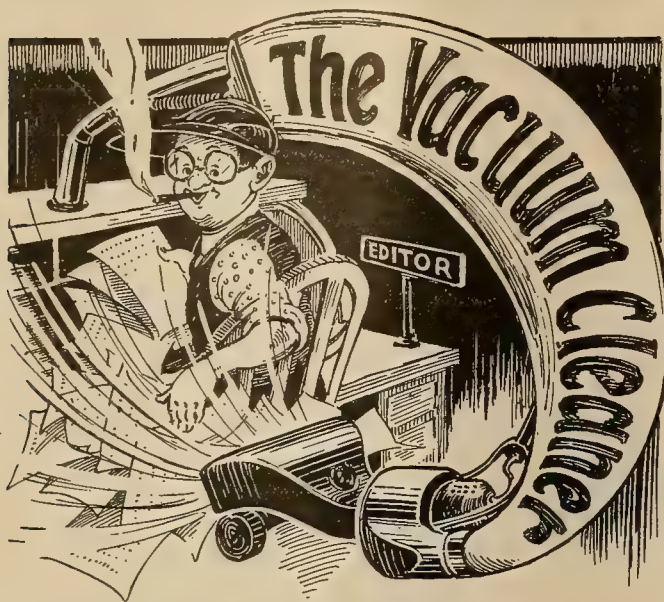
KAMAS, UTAH.—The Kamas-Woodland Telephone Company has asked for an increase in rates on the ground that its present income does not even meet operating expenses by about \$200 a month. The company would charge \$5.00 instead of \$3.50 a month for business telephones, and \$3.00 instead of \$2.00 for residence telephones outside of Kamas, increases being asked in all other rates, intermediate. Application for increased rates has been filed with the Public Utilities Commission of Utah.

PARIS, IDA.—The Bear Lake Phosphate Company has practically completed the installation of machinery necessary to insure operations on a large scale. They have also built several structures to house equipment. The compressor and motor installation is now complete, and electric power will be available at the mine very soon. The company intends to buy an electric locomotive, which will put the tramming of ore on an efficiency basis. Electricity will be used to light the mine, as well as in other operations where it can be employed to advantage.

BOISE, IDA.—In the dispute between Boise City and the Idaho Power Company in regard to the street lighting and the cancellation of a municipal franchise granted to the Beaver River Power Company, application for a rehearing in the case before the public utilities commission has been made by Boise City. Boise City makes its application on the grounds that it has been denied due process of law, in violation of the Fourteenth Amendment to the Federal Constitution, by order No. 672 issued by the commission.

BRIGHAM CITY, UTAH.—The extension of the lighting system the full length of Main Street to conform with the white way in the business district is now being made by the city. The same type of light as in the white way will be used in the new units on North and South Main, but the lights will be suspended over the center of the street at the intersections from a cable supported by poles at the curb on each side of the street, instead of on light standards at the curb line. This new system will cover a distance of ten blocks and will illuminate Main Street from one end to the other, making a handsomely lighted thoroughfare.

SALT LAKE CITY, UTAH.—Owners of land in the southern end of Davis county, known as the Bonneville irrigation district, have voted in favor of bonding their property in the sum of \$600,000, for the construction of an irrigation pumping system with the highest lift of irrigation water yet known in Utah. It is planned to build a system which can lift forty cubic feet of water per second out of the Jordan river, and up to a height of 300 feet above the level of the river. The pumping plant, which will be situated about half a mile north of the Davis county line, will take its electric energy from a 44,000-volt line of the Utah Power & Light Company. The present designs of the pumping station call for four motors and four pumps. Two of the motors will be of 900 hp. and two of 500 hp., operating pumps respectively for the 300-ft. and the 150-ft. lift.



The air is a rich source of power, according to a Hamburg scientist, who proposes to obtain a cheap supply of energy from the air by sending up metal balloons to collect electricity. Personally, we never found metal especially buoyant or inclined to blow away, otherwise we might worry about how he was going to get them down again.

* * *

Color, say the psychologists, is a very important factor in life. Somebody else adds that it must be, because it is the cause of race riots, Russia, and pink eye. It also seems to be the cause—or cure—of mosquitoes, according to an account of certain tests made with these sociable little insects:

Experiments have been conducted in a gauze tent, one end of which was formed by large windows. Stone basins were placed for the mosquitoes to breed in. Boxes lined with cloth of various colors were placed upon the floor, and it was noticed that great numbers of mosquitoes entered the box lined with dark blue. Fewer of the insects sought the boxes lined with other colors, the number diminishing in this order: Dark red, brown, scarlet, black, slate gray, olive green, violet, leaf green, blue, pearl gray, pale green, light blue, ochre, white and orange. No mosquitoes whatever were found in the box lined with yellow.

The moral of this is that wall paper and outing suits should be orange or yellow, with light blue spots introduced for variety.

* * *

The Red Peril, the Yellow Peril and all the other perils have made color quite an obsession with us this time, and having given a good deal of useless information about it we may as well give a useful item, too. The following list was compiled by experts to show the order of legibility for various combinations of colored printing and colored paper—the distance from the eye, the size and form of type and other factors being the same in each case.

1. Black letters on yellow paper.
2. Green letters on white paper.
3. Blue letters on white paper.
4. White letters on blue paper.
5. Black letters on white paper.
6. Yellow letters on black paper.
7. White letters on red paper.
8. White letters on green paper.
9. White letters on black paper.
10. Red letters on yellow paper.

* * *

Railroad electrification reminds us that transportation is not what it used to be. There is a story of a passenger on a southern train who was carried past his destination.

"Heah, conductor!" he shouted, "That was my station, suh! Why didn't you stop theah, suh?"

"We don't stop there no more," said the conductor. "The engineer's mad at the station agent."

And there were some railroads that went in still more for the human touch:

A certain traveler on being asked when purchasing a ticket if he wished to travel first, second, or third-class, was told that there was not much difference except in the fare, and decided to travel third-class. When the train started he noticed that all classes of passengers seemed to be on exactly the same basis and was curious as to what the distinction might be. After several hours of travel the train arrived at the foot of a very long hill and stopped. The conductor came down the line calling:

"First-class passengers stay aboard; second-class passengers get out and walk; third-class passengers get out and push."

* * *

THE ELECTRICAL CONTRACTOR

I've followed this little old 'lectric game
For nigh onto twenty year.
I've had my ups and downs just the same
As you must have had that's here.
I've made some good money and spent some more,
And I've worked with the tools myself,
I've kept my own little retail store
With a nice clean stock on the shelf.
I've figured some jobs by guess and by rule,
I've tried both the old way and new,
I've weighed and measured and guessed like a food,
And I've counted each socket and screw.
I've allowed for the overhead—heat, light and rent,
Not an item I've missed I'll be bound,
But when I've collected the very last cent
There's never enough to go 'round.
So I have decided this contracting game
Is not a safe one to be played,
I'll work just as hard and figure the same
But some profit has got to be made.
Hereafter my bid for every blamed one—
I don't care for whom it may be,—
Will be all of my costs for the work when it's done
Plus a nice little profit for me.

And now to you fellows still trying to live
On the profits you never have made,
Just a piece of advice let an old-timer give,
'Cause he's through with the game as it's played.
Quit guessing at prices and labor that's lost
And hoping 'gainst hope you'll pull through;
Take all future jobs on the basis of cost
Plus a nice little profit for you.

S. W. LEAVER.

* * *

Sidelights on the field of journalism are afforded by a recent advertisement in an "Employment Wanted" column, in which a young lady having charge of the "fiction department of the XXX International News Service" desires a position in an advertising department. Of course we learned during the war that a great part of international news came under the head of fiction, but this is the first time we have seen fiction writing proffered as a qualification for advertising work.

* * *



Through irrigation and other methods electricity is still coming to the rescue of dry places. The very dry are promised a bona fide kick from this electrified water.

IN THIS ISSUE: Marketing Power Company Securities

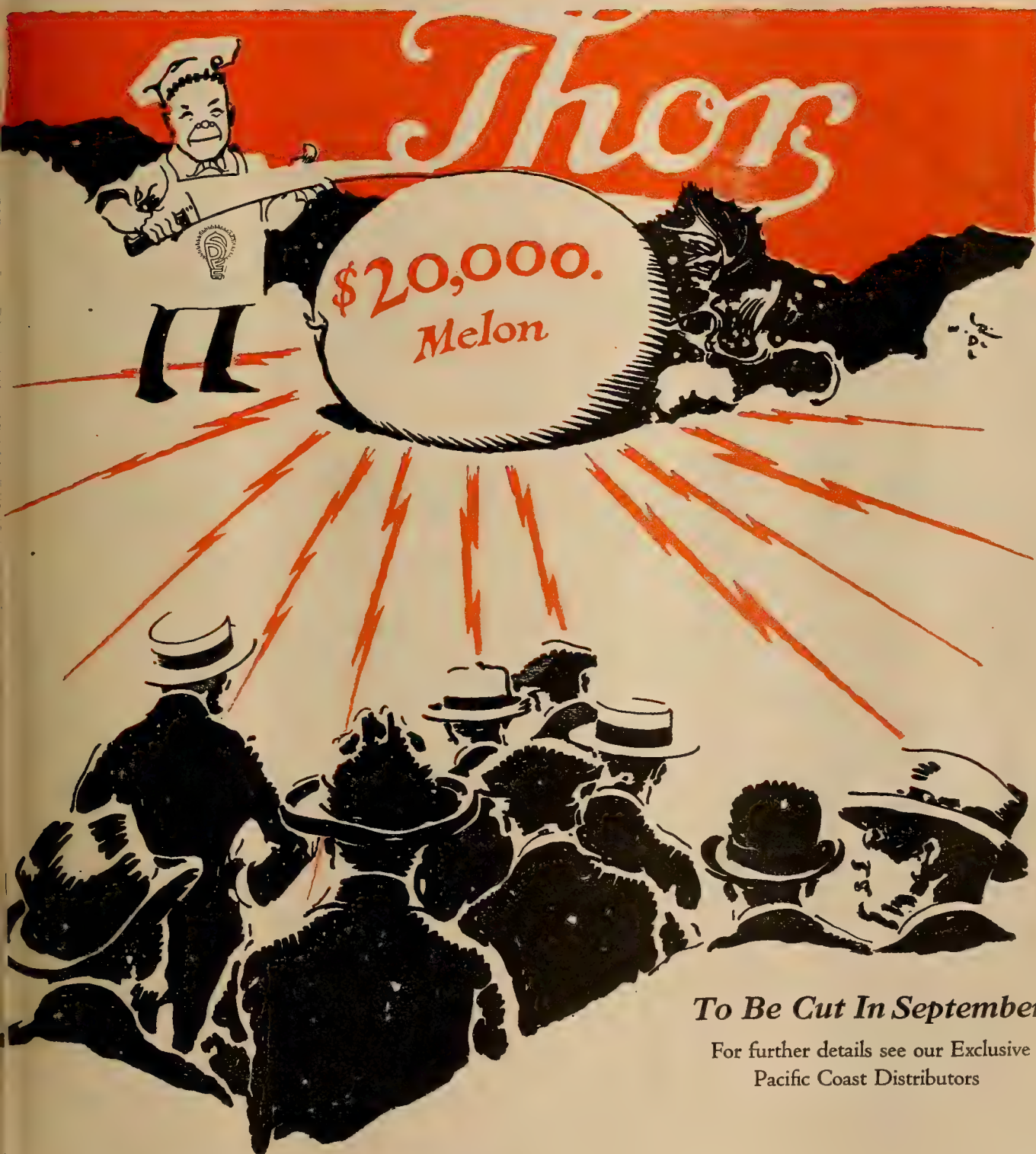
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THE AEROPLANE A COMING FACTOR IN THE POWER INDUSTRY OF THE WEST

The aeroplane has passed the stage of experimentation in the service of the power companies of the West. Inaccessible mountain power developments and vast distances involved alike in construction and distribution, offer an opportunity for this swift and flexible means of conveyance of which advantage is already being taken in such instances as the fire patrol regularly a part now of western forest service, the definite proposal of the Southern California Edison Company to expedite construction by the aerial transportation of essential preliminary machinery in districts where roads have not yet been constructed, and the recent announcement by the San Joaquin Light and Power Corporation of the construction of landing fields on their mountain projects. The plane here shown is that of R. C. Starr, who had entire charge of construction on the recently completed Kerckhoff project and who has adopted this method of expediting transportation between construction jobs.



JOURNAL OF ELECTRICITY



DEVOTED TO THE UPBUILDING OF THE ELECTRICAL INDUSTRY IN THE WEST
AND IN THE COUNTRIES BORDERING THE GREAT PACIFIC

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Electric Utility Financing Should Be Supported

An Editorial

The program of construction which was announced at the recent N. E. L. A. convention this spring, and which it was estimated would call for the expenditure in the West of \$700,000,000 in the next 9 years has already been begun—and the financing of this construction has become one of the major functions of the electrical industry of this coast. More, it has become a question of major concern to the West itself. Because it believes in the future development of the West and because it believes that this development is inextricably bound up in the adequate growth of the electric companies which serve it, the Journal of Electricity desires to say its word in the support of the stock and bond issues of electrical companies now on the market and those which will hereafter call upon the public for the money to carry out their construction programs.

The West in its natural resources is one of the wealthiest regions of the nation. It stands foremost in fruit production and ranks high in dairy and cattle products. Its mineral wealth places it in the first rank in this field; its standing timber makes it the great lumber region of the nation. This development both in agriculture and industry is only in its beginnings. It is as yet undetermined exactly what effect the raise in freight rates will have on industry on the Pacific Coast, but it is certain to mean that more and more will the raw materials of which we have so bountiful a supply be made up into finished products on this coast for use in local markets and for shipment in the more compact form, both to the Eastern markets and the Orient.

What is perhaps not so well understood is the close relation which the development of the electrical industry bears to this growth of the West. Western agriculture is dependent upon irrigation. To as great an extent as possible, of course, gravity irrigation is used, but this is limited in the areas which it will serve and electric pumping has long since taken over a great share of the burden. Thousands upon thousands of acres of land now under cultivation are entirely dependent for their fertility upon electric pumping—and the great acres which await cultivation are largely looking to the services of the electrical companies to make them available for agricultural purposes. In this last year of water shortage,

when the power companies were unable to take on new service, thousands of applicants were unable to install the pumps they desired, thousands of projects were postponed until electricity should be available. The one instance of the rice growers of California, who are almost entirely dependent upon electricity for their water supply and who this year were forced to restrict their intended acreage owing to the power shortage, is proof of the intimate relationship between electricity and agriculture in this state.

Industry is not less dependent upon hydroelectric power. The West has no adequate supply of coal; lumber, although plentiful, is not present in such a surplusage as to make it available as a fuel except in restricted districts, and the price of oil is becoming almost prohibitive. This tends to make all industry dependent upon hydroelectric sources for its power—but beyond this fact there are many lines of activity which are inseparably linked with cheap and reliable electric power. Such a one is the electrochemical field which is coming to be one of the important industries of this region. There are tremendous chemical deposits west of the Rockies which have hitherto been shipped east in the raw. The combination of high freight rates between the Eastern markets and this coast and higher power rates in the East has tended to increase the refining of these products in the West, an industry wholly dependent upon electric power for its possibilities of existence. The use of electricity for industrial heating purposes is coming to be quite general and the many industries which are dependent upon the use of electric furnaces are another instance of dependence upon this source of power.

The western region as a whole stands first in its per capita consumption of electricity, the average citizen in this region using 2.2 times as much electricity as the average citizen in the remainder of the United States. The Pacific Coast already uses more electricity on its farms than all the rest of the United States put together and the dependence of its future upon electric pumping shows that this ratio will be increased, as well as maintained.

Figures of power development within the past ten years and predictions of what will be needed in

the future show strikingly how the growth of the region is paralleled by this great "servant industry." Last February, in view of the fact that a very distinguished convention of the National Electric Light Association was to convene at Pasadena during May of this year, a group of men prominent in the power industry met in San Francisco in order to formulate a report on the water power development of the West which should convey in an authentic and authoritative manner the statistical data concerning water power in the states west of the Rockies. On this committee were Mortimer Fleishhacker, W. A. Brackenridge, John A. Britton, H. T. Edgar, C. C. Egbert, H. I. Harriman, D. L. Huntington, H. F. Jackson, Frank M. Kerr, A. W. Leonard, J. D. McKee, G. W. Talbot, A. B. West, A. G. Wishon and Franklin T. Griffith. It was decided to put into the field at once a committee of investigation to gather these data and the Journal of Electricity was asked to superintend the work. The results of this investigation which were reported in full at the Pasadena convention, contained statistical information on power development which is epoch-making in its proportions.

In the first place, by combining the actual power that has been consumed by the power companies of the West during the last twelve years and superimposing these curves one upon the other, a total power curve of power usage was derived. Perhaps the most significant aspect of this curve is the fact that its upward progress is steady. If a curve of the unsatisfied demand could be plotted and run simultaneously, a fact would be apparent which these figures cannot show—that is, that the need for power has increased at an even greater rate than it was possible to supply it. The war did not lessen the demand appreciably, while at the same time it postponed the possibilities of construction, and the present situation is one of existing power shortage in California and impending shortage in other districts of the West. Agriculture, industries and city development alike are being cramped for need of the power to supply them at the rate they stand ready to expand.

This curve of power demand was then extended over the period of eight years immediately before us, anticipating what power development must be undertaken to meet these needs. Figures used were based on most careful estimates of the power companies serving this region upon actual demand anticipated and represent, if anything, a conservative picture of possibilities. The usage of power has been increasing for years past in an expanding geometric ratio and it is estimated, based upon these figures, that something like \$700,000,000 must be expended in power development in the West alone within the next nine years to meet the growing demand in industry and agriculture.

So completely is the regulation of public utility companies in this state within the hands of the public utility commission, that the assurance of an adequate return to investors who shall supply the funds for this necessary construction lies largely within the

powers of this commission. So clearly do the Western commissions realize their responsibility and so progressive is the stand that they have taken that E. O. Edgerton, the president of the California Railroad Commission, in a forceful address at the Pasadena convention, could express himself as follows:

"I believe that we have assets in California which, if properly used, will produce the fundamentals of inducement to investors, this being absolute security of the investment itself, the assurance that the dollar will not become 90 cents or something less, coupled with the certainty and regularity of return. And if we have these assets, why not make use of them, and then if money is available on any terms, we will get that money.

"What are these assets? Power houses and transmission lines? Surely. But over and above that we have the assets of a great, vital, essential service—a service which the people must have, a service which they cannot get along without. And that is an assurance to an investor that that asset cannot disappear. My judgment is that the Railroad Commission has that asset in trust for the people, and I think they can make bitter complaint if we do not use that asset, coupled with others, so as to produce the necessary money to do the absolutely essential development that must go forward in this state."

In view of the facts, then, that fundamentally the West will progress only so fast as hydroelectric energy is placed upon the transmission lines, and that the state of California of the forty-eight states of the Union is outranked by only one other in possibilities of this development, and, thirdly, that every citizen is vitally interested in this development, and, fourthly, that agriculture and industry today in this great commonwealth are demanding power in ever-increasing capacity at a rate at which development will find difficulty in keeping pace with the demand, it would seem that an investment in these securities today presents the soundest type of investment that can be found. And the thing which the Journal of Electricity has in mind, alluded to in the opening statement of this editorial, is that, so indelibly are the progress and industrial and agricultural development of this region intertwined with the development of its hydroelectric resources that our citizens should give every encouragement possible to this development; and insofar as these companies are faithfully and efficiently and in a businesslike way proceeding about the development of these great resources, the people of this great district should reward them for their service by liberally backing them up in seeing to it that a reasonable, indeed a generous, return be given to them on the moneys invested.

During the past several months the people of the West seem to be awakening to this fact, and as a consequence investors in these securities may feel well assured that the regulatory bodies who have in trust the fixing of rates will see to it that reasonable returns be allowed in earning power so that these developments may continue in ever-increasing geometric ratio.

To those who read the signs, the announcement by the San Joaquin Light & Power Corporation that it is to build aeroplane landing fields in connection with each of its mountain projects opens up a picture of the future usefulness of this means of conveyance in power development and maintenance. Ever since the war period the aeroplane idea has interested power company officials faced with the necessity of opening up districts into which no road has been built, of patrolling hundreds of miles of transmission line and of covering mere distances between points on their own systems which may lie a day's journey apart. The idea may now be said to have passed the point of mere speculation;—the aeroplane is actually at work in the service of the power industry and its province is unquestionably destined to be extended as its full usefulness comes to be appreciated.

For some time the aeroplane forest patrol has been a regular part of Western forest service and those who have recently been in the mountains are familiar with the purr of its guardianship overhead, even in the most inaccessible fastnesses of the high ranges. Power companies are equally concerned in preventing the menace of forest fires to their mountain properties, a problem the magnitude of which is to be judged from the fact that one day in August saw over two hundred incipient fires start in the forest ranges of California, most of which were reported at once and checked without damage. The suggestion inevitably presents itself that transmission lines are susceptible to the same method of patrol at a saving of considerable time and with great comprehensiveness. Records are already at hand of one instance in which pole trouble along a transmission line was reported to the company by a passing aeroplane.

Construction work on mountain projects is often delayed for months by the necessity of building roads or laying rails into an unopened region. It has been shown to be feasible to transport the lighter pieces of machinery by aeroplane, a possibility which should make for many time savings in construction work.

These are only beginnings, but they show the way to a real field for development, in which the aeroplane will become the serious servant of industry as well as a medium of sport and a weapon of war.

Far beyond the boundaries of California has gone the fame of the accomplishments of the California Electrical Cooperative Campaign. Forceful endorsement of this work was given by the Committee on Cooperation appointed by President Ballard to investigate the subject and which later reported upon it at the Pasadena Convention of the National Electric Light Association.

In the remaining districts outside of California, comprising the Pacific Coast States, great activity at the present time is being shown in the formation of similar movements. At Salt Lake City a move-

ment is under way which is to embrace the inter-mountain district, comprising Salt Lake City, possibly Butte, Montana, Boise, Idaho, and other intervening localities.

In Vancouver, British Columbia, a movement is under way to start a miniature cooperative campaign in that vicinity. The particular territory tributary to this district is very small, perhaps numbering seven or eight communities served by central station service. However, the evident desire to introduce active cooperative ideals is manifest on all sides in British Columbia.

But the one big place, or rather district, where the desire for the cooperative idea has grown to such an extent that it will unquestionably bear fruit, is the district comprising Portland, Seattle, and Spokane. The Advisory Committee of the Northwest Electric Light and Power Association, which has taken the matter of the formulation of a cooperative campaign under advisement, has already completed its policy and stands ready to present to the Association, at the forthcoming Spokane convention, its recommendation that a definite plan of cooperation as outlined by the committee be put into effect as soon as possible. The entire matter must, however, have the attention of all Class A members of the Association, and as a consequence it will be formally presented to them at the coming convention in September, at which time it is hoped that the report of the Advisory Committee will be adopted and the machinery set in motion for the cooperation of all electrical interests in the Northwest.

The Journal of Electricity has ever been a dominant factor in pointing the way towards the helpful principles of the cooperative idea. It has nourished and fostered the California development, and as a consequence it endorses wholeheartedly the action of the Northwest and commends in the highest degree the efforts of the Advisory Committee of the Northwest Electric Light and Power Association in its endeavor to get under way with a specific and definite plan of action.

The survey of industrial plants in California which use electricity as a main motive power, a digest of which appears on another page of this issue, presents a picture of industrial activity on the western coast which may be a surprise to many. About 1300 plants were included in the survey, of which the larger number were enterprises devoted to various aspects in the preparation of food-stuffs, but among which the iron and steel industries used the largest block of power. One of the unexpected features was the important position of the shipbuilding industries which may be said almost to have originated with the war but which have maintained their position in the first rank of electricity consuming industries into the peace period. The cement industry, the lumber industry and the electrochemical industry also rank high in relative importance. The vast field of agricultural uses has properly not been included as an industry.

The Cooperative Idea in the Northwest

Industrial Development in California

This survey has been extended to the other states of the West, but returns are available as yet only for California and even for this district are of necessity incomplete. The figures are sufficiently significant, however, to indicate the fact that the West is becoming an industrial district of importance. In spite of high freight rates, car shortage, water shortage, high prices and a business market somewhat depressed the power company load of this region has steadily advanced with a buoyancy which is the firmest guarantee of future growth and a tremendous asset in the marketing of Western public utility securities.

Each day new and interesting announcements are being made of the entrance of great new industries into the business life of the West.

Giant Industries Enter the West Not only has the institution of a silk manufacturing industry, amounting to some millions of dollars in capitalization, proven of recent interest in central California, but the entrance of the Goodyear Rubber Company into Los Angeles and vicinity, with its expenditure of twenty million dollars, is distinctly significant of the new industrial life of the West. Much has been heard throughout the West of the power shortage in California during the current season, and yet it is understood that this one industry, the Goodyear Rubber Company, will use power in such vast quantities as to equal the whole power shortage in California of the present year.

That the new freight rates from the East will have a tendency to encourage western industrial development is daily becoming more and more a conviction with those who study closely the situation in the West. While the initial cost will unquestionably be high in installations of this nature, nevertheless the future marketing of manufactured material on a competitive basis with other districts will be greatly facilitated. As a consequence, the entrance of new industries day by day is strengthening the spirit of optimism throughout the West.

One of the important results of the Pasadena N. E. L. A. convention was the formation of a Bureau of Public Relations which should place this vital work of publicity and research on a permanently functioning basis. One of the most wholesome signs of the sound progress of the electrical industry is their open recognition of this factor of their existence as essential. With the public utility properly answerable to the public for financial support and for the rewards for its services as well there is no more important aspect of N. E. L. A. work than to keep that public properly informed as to the facts of the situation. The foundation which was laid for the establishment of just such a bureau was one of the important contributions of the last administration and the announcement of the appointment of R. H. Ballard, vice-president and general manager of the Southern California Edison Company and former president of the N. E. L. A., to the chairmanship of this section and also to membership on the public policy committee is of vital interest to the

West. It has often been stated that the failure of most organizations lies in the confining of their work and influence to the one period of the year at which they convene.

The past semi-monthly period has witnessed the putting in of the Kerckhoff Power Plant of the San Joaquin Light & Power Corporation. This development work has brought forth unusual comment from all quarters, particularly in that there was a lack of material and a shortage of men throughout the construction operations; indeed at times the obstacles to be overcome seemed almost superhuman. Yet the work has gone forward on schedule time, and now, after the lapse of scarcely a year and a quarter since the great dam was undertaken, the long tunnel is driven and the power house is in operation. The thirty thousand kilowatts just made available will go far toward relieving the power shortage situation in south central California. The power development as it stands presents an unusually attractive feature for the corporation in that it not only utilizes the rivers of the San Joaquin and the waters farther upstream that are used in a chain of power plants owned by the San Joaquin Light and Power Corporation, but also it makes use of the Big Creek waters of the Southern California Edison Company, and indeed of all the waters which that company is to develop in the future. As a consequence, then, the Kerckhoff power development stands forth as an unusual installation in the expedition which has characterized its building, the foresight used in its installation, the maximum economy obtained, and the fact that full advantage has been taken of natural facilities.

Announcement is made elsewhere in this issue of the Journal of Electricity of the fact that a syndicate has underwritten a million dollars' worth of the 8% gold bonds of the Pacific Power & Light Company with the intention of disposing of them in central California. The Pacific Power & Light Company, as is well known to our readers, has its location along the Columbia River, both in Oregon and Washington, and feeds an unusually prosperous and growing agricultural community. The investment is unquestionably a sound one. The existing fact, however, is that California is to be invaded from the North with the sale of hydroelectric securities, and that 8% interest is to be offered on these bonds. The entire fact brings forcefully to mind the question of interest-bearing securities of this nature. Undoubtedly regulating bodies must come more and more to the conclusion that greater returns than 7% must be allowed on securities of current issue if a ready market is to be found for them. That California is subject to invasion from the North only instances the fact that other communities are allowing larger rates of return, and as a consequence if the vast financing is to be accomplished in the West that it is confidently believed will take place, liberal returns must be allowed upon the money so subscribed.

The Selling of 8% Bonds in California

It is an interesting fact that two-thirds of the leading power companies of the West showed an increase in their corporate surplus from 1918 to 1919, and in the cases where this surplus decreased there was a very good reason for the decrease. While a comparative table such as that appearing on another page of this issue of the Journal of Electricity, showing the balance sheets of the larger power companies, can furnish many very interesting facts, still, conclusions should not be drawn too hastily. The decrease in the surplus of the San Joaquin Light & Power Corporation, for instance, is due to the fact that that company during 1919 was carrying on a great construction program and had not yet marketed the bonds which were to pay for these additions to its properties. This bond issue is now being rapidly sold and will replenish the money which that company borrowed from itself. As another instance of judging too hastily, consider the case of the Portland Railway Light and Power Company, which shows that no dividends were paid last year. While this company is making a fair profit on the electricity it sells for light and power, the railway system of Portland is draining the company of its profits on the other sales. Now that the fares in that city have been increased the system will not have to carry an extra burden, but will be able to make a profit that will assure the stockholders of the company a fair rate of return on the money they have invested.

The Journal of Electricity believes that it is a good thing to bring the balance sheets of the various Western power companies to the attention of the members of the electrical industry. We are all vitally concerned with the financial condition of the central stations, as it affects the welfare of every member of the industry. If the power companies are making a fair profit on their investment we should know it and tell the story of the stability of the industry. But if the power companies are not making a fair return, then it should be the duty of every member of the industry to see why. If the company is suffering from inadequate rates this fact should be brought to the attention of the regulatory commission of the state in which that company is located. It should be borne in mind that your local power company is the

gauge of your business condition; that as it prospers and as it suffers from inadequate rates, just in that proportion will the prosperity of your business suffer.

The majority of the Western power companies have schemes for selling their securities to consumers and employees, as it is a recognized fact that a widespread distribution of stocks or bonds among consumers and employees is a very desirable thing. As an instance of this it should be noted that when the San Joaquin Light & Power Corporation recently applied for an increase in rates a large number of consumers of that company who were also financially interested in the company to the extent of one or two bonds, appeared before the Railroad Commission with a request that the increase be granted. Being stock or bondholders in the company gave them an opportunity to know that the development of their community depended upon the healthy financial condition of their local power company.

The stock selling plans of several representative power companies of the West appear on another page of this issue of the Journal of Electricity and if every member of the electrical industry were to take advantage of one of the investments offered there, it would be a great help in solving the problem of financing which now confronts the Western power companies. That nearly a billion dollars is to be spent in hydroelectric construction in territory west of the Rockies in the next ten years is now a well known fact; if every member of the electrical industry supports his local power company financially as well as morally, this big construction program can be put over. The purchase of some securities of your local power company will prove that you believe in the future of the West, that you have confidence in the electrical industry and the part it will play in the up-building of the West, and that you believe in yourself. The California Association of Electrical Contractors and Dealers have adopted a placard which will be placed in the window of every member owning some central station security, and some mark should be given to those who have invested in any central station security in the West so that the "slackers" might be easily recognized.

THE INDUSTRIES OF THE WEST

are growing through the use of hydroelectric power.

Something of this development will be told in the September 15th issue of the Journal of Electricity.

The romantic story of a large Western power company, as personally told by its general manager, will be given.

This issue will also contain the latest word from the Spokane Convention of the Northwest Electric Light and Power Association.

Financing Public Utilities

(The extensive construction programs planned by Western power companies for the next ten years will call for the expenditure of vast sums of money. How this money is to be raised is the most vital question now before the power companies, and some of their plans for handling it are described below.—The Editor.)

It is a recognized fact that the greatest problem of the western power companies in the next decade is that of raising sufficient money to carry on the vast construction program which they have outlined as necessary to keep up with the industrial development of the West. The need for this was very ably stated by E. O. Edgerton, president of the California Railroad Commission, at the N. E. L. A. convention at Pasadena last May when he said:

"I recognize that we cannot get money out here from the East into California by threats, by arguments, by any form of punishment, by any suggestion that because of investments already made they cannot quit. I recognize that the money must come by inducement, and in my judgment it can be induced without paying an exorbitant and unreasonable price for it. I believe that we have assets in California, which if properly used will produce the fundamentals of inducement to investors, this being absolute security of the investment itself, the assurance that the dollars will not become ninety cents or something less, coupled with the certainty and regularity of returns. What are these assets? Power houses and transmission lines? Surely. But over and above that we have the asset of a great, vital and essential service—a service that the people must have—a service that they cannot get along without, and that is an assurance to an investor that that asset cannot disappear. My judgment is that the Railroad Commission has that asset in trust for the people, and I think they can make bitter complaint if we do not use that asset coupled with others so as to produce the necessary money to do the absolutely essential development that must go forward in this state."

It is easy to see, by applying the self-interest idea, why every member of the electrical industry should subscribe to the securities of the central station which supplies him. The central station may be likened to the reservoir which is built in the mountains, and the other branches of the industry could be likened to the power house and the transmission lines: each a complete thing in itself and yet perfectly useless without the other. When your central station is in a healthy condition it is expanding—which necessitates the buying of new material—and is supplying a large and possibly increasing amount of current to its consumers. The activity of this central station is reflected upon the manufacturer, the jobber and the contractor-dealer in that territory, and they prosper as the central stations prosper.

In presenting the various stock selling plans of the following power companies of the West, it is with the idea that every member of the electrical industry in the territory served by that central station will thereby become acquainted with the securities that company has for sale, will see to it that his customers are acquainted with the value of this security, and will show his confidence in that company by purchasing some of its stock.

Pacific Gas & Electric Company

In answer to a questionnaire, Mr. A. F. Hockenbeamer, second vice-president and treasurer of the Pacific Gas & Electric Company of San Francisco, California, stated as follows:

"It is not likely that we will issue any hundred dollar bonds, as we have in our first preferred six per cent stock issue a very excellent medium of effecting a wide distribution of the ownership of this property. We believe that this stock issue is not only for all practical purposes as safe a medium of investment as bonds, but can be sold to give the investor a substantially higher return. It also possesses the advantage to the investor of being exempt from the Federal income tax, whereas bonds in any of the so-called tax-free covenants are exempt only to a maximum of two per cent. The stock is purchasable in as small an amount as one share, of the par value of one hundred dollars. Dividends on the stock are paid four times a year as against semi-annual interest payments on bonds.

"We are thorough believers in the value of a widespread distribution of our securities among the people living in our territory, as evidenced by the fact that we were the first public utility in the United States to put this theory into actual practice. We made a beginning in June, 1914, a little over six years ago, and since then have distributed directly, over the counter as it were, more than \$8,500,000.00 par value of this first preferred six per cent stock among our customers and others living in the territory served by us. We have a widespread distribution of our stock and bonds, there being no less than 14,731 residents of California owners of these securities out of a total of 28,603. The distribution of public utility securities, whether they be stocks or bonds, among the jobbers, manufacturers, and contractor-dealers will undoubtedly help the industry, and we are very glad indeed to see the Journal of Electricity using its influence in the furtherance of this movement."

The securities of the Pacific Gas & Electric Company which are now on the market are their General and Refunding five per cent bonds, the First Preferred six per cent stock, the Original Preferred stock and the Common stock. They aggregate over \$67,000,000.00. While the Pacific Gas & Electric Company has no definite plans for stock or bond issues in the next five years, the construction program calls for an expenditure of over \$123,000,000.00, which must be raised by the sale of securities. In 1914 the Pacific Gas & Electric Company blazed the trail in the field of customer ownership, which has since then been established throughout the United States to such a degree that \$40,000,000.00 worth of central station securities are held by some 36,000 individuals, 90% of whom had never owned utility stock. California was a good place in which to make this experiment as it ranks twelfth among the states in population, but holds first place in per capita wealth.

The campaign put on by this company was started in June, 1914, by a circular being distributed to all of the officers and employees of the company. A few months later a circular was sent out to all consumers, about 260,000 in number, the addressograph used in making out the gas and electric bills being used to address the envelopes. A month later a second circular was sent out to practically all consumers, but this time the distribution was effected in each district by means of the collectors who delivered the circulars as they covered their routes in the performance of their ordinary duties. District managers and heads of departments were instructed in the advantages of this stock, and an advertising cam-

paign was carried on in the newspapers covering the districts served by the company. A stock sales department was established at the head office and as the result of this campaign on December 31, 1918, the total number of stockholders was 8,242, with average holdings of \$7,160.00 as compared with 2,898 stockholders in 1914, with an average holding of \$14,530.00 par value. The company has a plan whereby employees may buy stock on the partial payment plan which has been taken advantage of by a large number of the employees. The result of this is obvious, and the laborer who owns one share of stock is liable to be a great deal more interested in the welfare of the company than the magnate who holds a thousand shares.

Southern California Edison Company

The Southern California Edison Company has three stock issues, a First and Second Preferred and an issue of Common stock, of which there is \$35,116,272 outstanding out of a total authorized of \$100,000,000. The company's construction program provides for an annual expenditure of from \$10,000,000 to \$15,000,000 of which approximately 66 2/3 will be provided through the sale of bonds and the remainder by junior financing. Employees of the company are allowed to purchase stock in an amount ten times their monthly salary, that is an employee receiving \$100 per month would be allowed to purchase \$1000 par value of stock, or ten shares. There are two forms of contract by which an employee can obtain stock. The first one, which any employee can accept, is to deduct seven and one-half per cent of his salary each month and credit it to his stock account. The other contract is for those employees who receive less than \$100 per month, and by this contract one dollar per share per month is deducted from their salary and credited to their stock account. At the end of each quarter the dividend is credited to the employee's stock account and six per cent is charged on all deferred payments. In cases where an employee leaves the company without completely paying for his stock the amount he has paid in is refunded to him plus any dividends that have accrued to his account. If he has, however, sufficient money paid in to pay for one or more shares of stock, a certificate is issued for the nearest full paid share and the balance is refunded in cash.

A securities department has been formed which is under the charge of A. N. Kemp, vice-president in charge of finance. This department in addition to planning the campaign for the sale of stocks, writing the advertisements, etc., also handles the transfer books and mailing of dividends, and furnishes information to the stockholders. A campaign to sell the common stock was launched in August, 1917, since which date over \$8,500,000 worth of stock has been sold, to a total of eight thousand subscribers. The advertising has been done by means of the newspapers in the territory served by the company, and it has been found that the best results have been obtained by short, sharp advertising campaigns of four or five days spaced a few months apart. The entire company's force of about 3,000 permanent

employees has become a sales organization with the district managers as direct sales representatives. About fifteen per cent of the sales were made by the banks with which the company had accounts, all of which had subscription blanks.

San Joaquin Light & Power Corporation

Situated in the San Joaquin Valley, whose development has been held back by a lack of power, the San Joaquin Light & Power Corporation has started the sale of \$10,000,000 of 7% Preferred stock directly through the company on the "Self-Interest" plan which was conceived by A. Emory Wishon, assistant general manager of the company. Through



The effective newspaper advertising which the San Joaquin Light & Power Corporation used in financing its recent bond issue

this plan of proving to consumers and employees that it is to their best interests to see the valley developed, which is only possible through the development of large amounts of power by the company, they are going ahead selling on a cash basis, except to employees who can purchase stock at the rate of \$7.50 per month. In the past year the San Joaquin Light & Power Corporation have practically doubled their capacity and the faith that this company has in the future of the valley is being rewarded by the way in which they are disposing of their stock issue.

The advertising for the sale of this issue has been carried on by using the newspapers, magazines, follow-up letters, and printed notices on the back of all outgoing bills and letters. The moving picture has played a part in the company's campaign also, as a film has been made showing the construction of the Kerckhoff Power House, which has just recently been put into operation, and showing also the manner in which the use of electricity develops and enhances the value of the lands in the valley served by the company. The company have also endeavored to interest the local public in their securities by means of advertising and general education to give interest to the story of electricity, to interest every individual in the territory served in the financing and development of the company, and to show that their own individual interests and the development of their own locality depend on the growth of the company and its ability to develop sufficient electricity to supply the rapidly increasing demand.

Great Western Power Company

The Great Western Power Company have a plan of selling to employees the Preferred stock of the com-



Riverside Avenue, in the heart of the business district of Spokane, Washington, is shown on the left. Down River Drive, one of the beautiful motor roads in Spokane, is shown above. This city which will be the hostess of the Northwest Electric and Power Association, September 8-11, is the distributing and financial center for a territory of approximately 400,000 square miles and with a population of nearly 3,000,000.

The Spokane Convention

(The thirteenth annual convention of the Northwest Electric Light and Power Association which is to be held in Spokane from September 8th to 11th inclusive will be of interest to the entire Pacific Coast. A comprehensive program has been arranged, the details of which are given in this article.—The Editor.)

The thirteenth annual convention of the Northwest Electric Light and Power Association will be held in Spokane, September 8-11 inclusive, at the famous Davenport Hotel with an anticipated attendance of 250 members. An entertainment program is now being worked out by a local committee headed by W. E. Coman, vice-president and general manager of the Washington Water Power Company. Special arrangements will be made to provide for the ladies and everybody attending will be given opportunity to visit the Interstate Fair, then in progress.

President J. B. Fiskien and Secretary L. A. Lewis, both of the Washington Water Power Company, Spokane, have prepared a program for the convention proper which is not yet complete as to speakers.

Martin Insull of Chicago, president of the National Electric Light Association, and M. H. Aylesworth of New York, secretary of that organization, have been invited to attend.

A feature of the convention will be the meeting at the same time of the new committee on hydraulic power. Those members of the committee who are expected to be present are Markham Cheever of Salt Lake City, chairman; J. B. Fiskien and B. M. Merritt of Spokane; H. H. Schoolfield of Portland, Oregon; G. C. Sears of Seattle; H. A. Barre, Los Angeles; J. P. Jollyman, San Francisco, and C. O. Poole, Riverside, California.

The program as it now stands is as follows:

Wednesday: Reports and president's address, J. B. Fiskien, 2 p.m. Report of the Accounting Section, J. S. Simpson, chairman, 3 p.m. Review of N. E. L. A. range and water heater report, A. C. McMicken.

Thursday: Report of hydro-electrical and technical section, Geo. Quinan, 2 p.m. Discussion of hydro-electrical and technical report safety reports.

Friday: Report of advisory committee on "Cooperation of Electrical Interests," R. J. Clark, chairman advisory committee, 2 p.m. Public Utilities Competition, Geo. L. Myers, Public Relations Section, 3 p.m. "Successful Public Utility Management of the Future," Franklin T. Griffith.

Wednesday noon an address will be made by an official of the N. E. L. A. before the Spokane Advertising Men's Club.

Thursday night an open address will be made the citizens of Spokane on some public utility subject, and Friday night the annual banquet will be at the Davenport Hotel. Saturday there will be competition for the Kilowatt Golf Club cup at Hayden Lake.

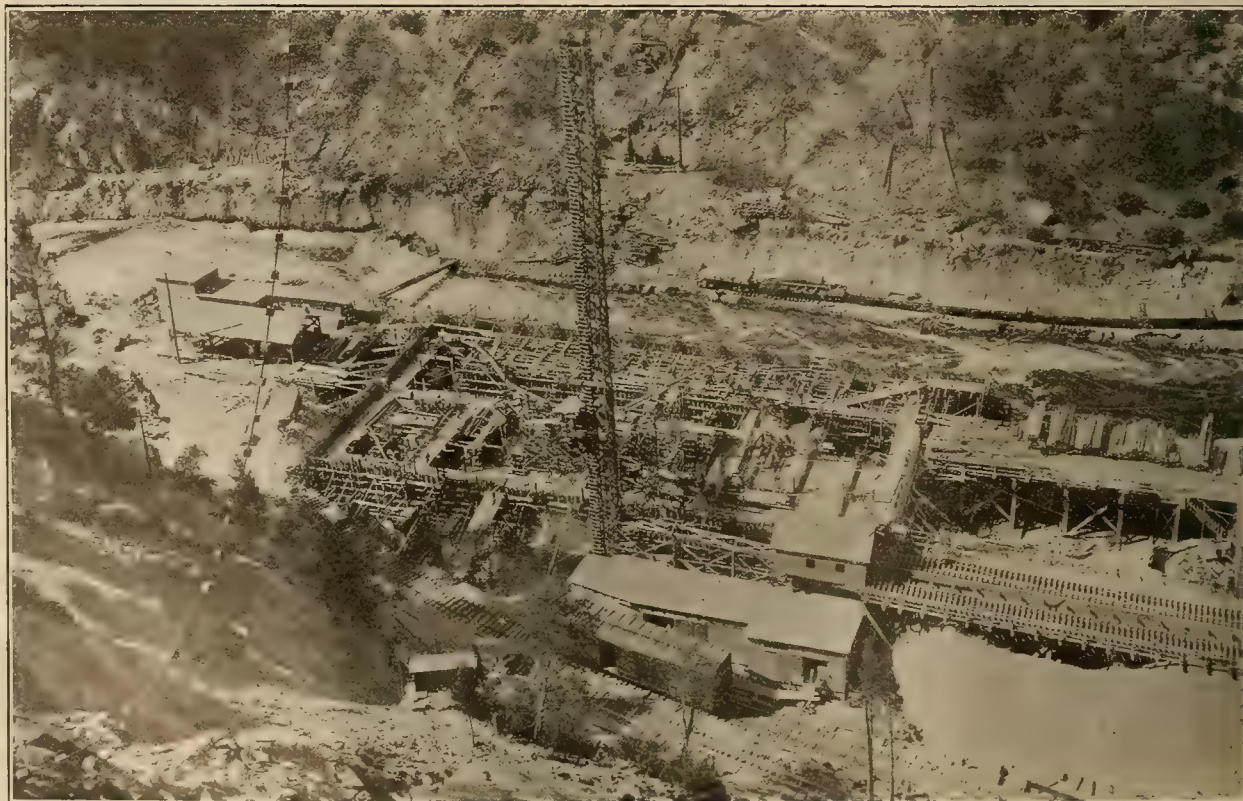
It is rumored that many plans are being made to entertain visiting delegates with the aid of near-by mountain drives and lakes and beautiful municipal parks and golf links. Within a hundred-mile radius of the city over 60 mountain lakes offer splendid accommodations and the best of hunting, fishing, bathing and boating. In a few hours by motor, one can be transported into the untouched wildernesses.

Forestalling Another Power Shortage



Digging new channel for North Fork of Feather River to allow Caribou plant to be built in old channel

By the fall of this year the Great Western Power Company of California will have installed 185 miles of the highest voltage transmission line in the world, extending 190 miles from Caribou on the north fork of the Feather River to San Francisco. The first two units of the Caribou plant, the second plant on the system, will be put into operation early in 1921, and will bring the total capacity of the system up to 139,500 kw. The ultimate installed capacity of Caribou will be 120,000 kw. The estimated expenditure required to complete the development of the river by means of a chain of seven power houses, amounts to about \$76,200,000, some \$10,674,900 of this being estimated as the cost of the Caribou plant and transmission lines. To defray some of this expense the company has recently been authorized to issue \$3,500,000.00 of 8% ten-year bonds.



View of the Caribou plant of the Great Western Power Company, from the hill behind the power house.



Starting the Shaver Lake Tunnel on the Big Creek System of the Southern California Edison Company. This will connect Shaver Lake with Huntington Lake through Big Creek power house No. 5, and will involve tunneling through 5.75 miles of solid rock. Power house No. 5 will be developed to an ultimate capacity of 100,000 hp. under a head of 1480 ft.



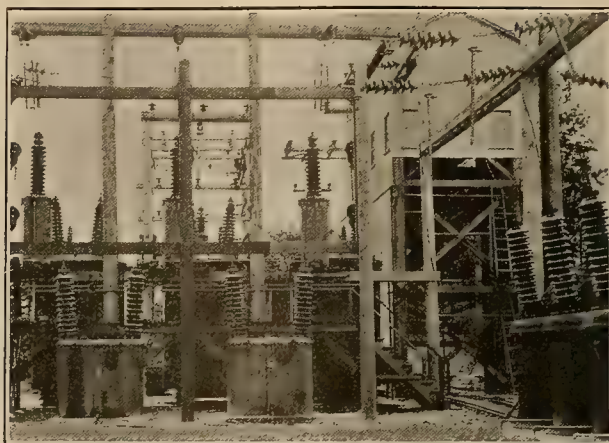
Vestal substation on the Southern California Edison Company's system. The company's generation program for the next ten years involves an addition of 472,000 kw. hydro and 60,000 kw. steam to its existing capacity, and plans are under way to convert the transmission lines of the Big Creek System from 150,000 to 220,000 volts, thereby doubling their capacity to transmit load.



Interior of the Kerckhoff power house, San Joaquin Light & Power Corporation, showing No. 1 unit completed and units Nos. 2 and 3 under way. These were completed in record time, and placed in operation August 15th of this year. The present capacity of the plant is 30,000 kw. and it will be connected with the McKittrick substation by 110,000-volt transmission lines.



Removing rock from the tunnel line on the San Joaquin Light & Power Corporation's Kerckhoff project. This tunnel which was one of the notable features of the construction work, measures 18 ft. by 18 ft. and extends a distance of $3\frac{1}{2}$ miles through solid granite. A steam shovel was used inside the tunnel, and electric storage battery locomotives carried out the burrowings.



The view above shows an outdoor substation at Snoqualmie, Washington, on the recently interconnected system which supplies power to the Chicago, Milwaukee & St. Paul Railroad. The work on this interconnection of the systems of the Washington Water Power Company, the Pacific Power & Light Company, and the Puget Sound Traction Light & Power Company occupied two years, and necessitated among other things the building of numerous substations to change the 100,000-volt current to 3,000-volt d.c. for the locomotives.

At the left is shown the construction on the 100,000-volt transmission line of the Chicago, Milwaukee & St. Paul Railroad sixteen miles east of Butte, Montana. The span here is 675 ft., and the photograph shows the method of guying and dead ending at corner points.



View showing progress being made on the construction of the Pacific Power & Light Company's new gas and steam electric generating station located at Youngs Bay, Astoria, Ore. This is to be a reinforced concrete building 90 ft. by 111 ft. by 50 ft. high, with a stack 220 ft. high and 10 ft. in diameter at the top. It is expected to be completed by October of this year, and will have a generating capacity of 3750 kva.

The Spread of the Cooperative Idea

(One of the most significant features of the California Electrical Cooperative Campaign, next to its success in its own territory, is the manner in which its fundamental idea is spreading throughout the Pacific Coast states and leading to the formation of new cooperative societies. Some account of this is given below, together with a few recommendations compiled by the California Campaign.—The Editor.)

One of the questions of importance to be taken up at the coming convention of the Northwest Electric Light and Power Association, September 8-11, is the formation of an Electrical Cooperative Campaign similar to that now operating in California. The success of the California movement has already inspired similar activities in Salt Lake City, and across the Canadian border.

British Columbia Electrical Cooperative Association

For the purpose of promoting electrical development and the more extensive sale and use of electrical appliances, the British Columbia Electrical Cooperative Association has been formed at Vancouver, B. C. Preliminary meetings have been held of the leaders of the movement and a general rally of all the men in the industry around Vancouver has been called for a date early in September.

The president of the association is George Kidd, general manager of the British Columbia Electric Railway Company, and its vice-presidents are R. F. Hayward, general manager of the Western Power Company of Canada, W. G. Murrin, assistant general manager, British Columbia Electric Railway Company, and William McNeill, assistant general manager, Western Power Company.

There is also an advisory council composed of E. E. Walker, sales engineer, British Columbia Electric Railway Company; E. Brettell, president of the British Columbia Association of Electrical Dealers and Contractors; J. R. Read, local manager, Canadian Westinghouse Company; H. Pim, local manager, Canadian General Electric Company; J. F. Little, local manager, Northern Electric Company; James Lightbody, publicity manager, British Columbia Electric Railway Company; W. W. Fraser, electrical contractor; S. E. Jarvis, Jarvis Electric Company; F. T. Cope, F. T. Cope and Son, and E. B. Horsman, Horsman & Company.

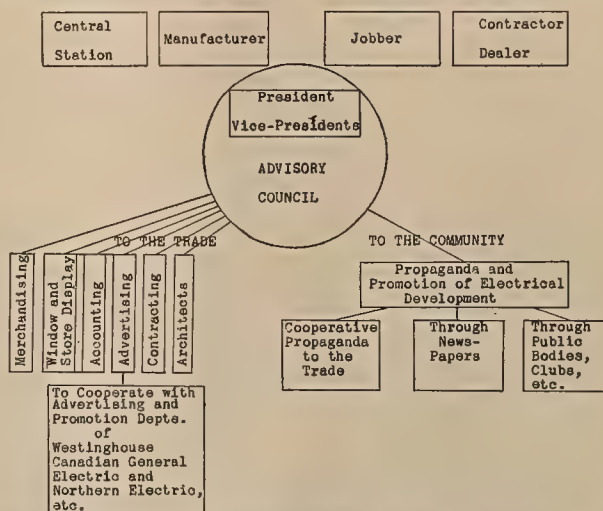
Of the advisory council E. E. Walker is chairman, E. Brettell vice-chairman, and James Lightbody honorary secretary-treasurer.

The association has been framed after the plan of the California Cooperative Campaign. The objects as set out in the constitution are:

- (a) To develop the electrical industry by educational methods, encouraging the practice of good ethical business methods and of improved service to the public.
- (b) To develop a closer cooperation and understanding between central stations, contractor-dealers, manufacturers and jobbers, to the end that the efficiency of the various branches of the industry serving the public may be increased and that the customer may obtain better electrical service.
- (c) To help the contractor-dealers improve their business methods, including accounting, sales advertising and general store appearance, thereby elevating the plane of the retail branch of the industry.
- (d) To form a recognized body to promote electrical development in British Columbia, to support each branch of the industry when occasion requires and obtain fair treatment for invested capital on the part of the authorities by working

for a fair attitude towards electrical development on the part of the public at large.

At a preliminary dinner given by George Kidd to the officers and members of the advisory council figures were produced to show that only a fraction of the business in electrical goods was being done that



The plan of organization which has been laid out by the British Columbia Electrical Cooperative Association

ought to be done on a basis of population. It was estimated that sales of electrical household devices alone amounted to only \$200,000 a year, whereas on the basis of population they ought to amount to \$427,000. Similar increases should take place in sales of other electrical goods, it was pointed out.

Owing to the limited territory it is not thought possible to engage paid experts at present and the advisory council proposes to use volunteer help from the larger companies operating in the district. It is hoped to take up the following definite lines: accounting, advertising, store and window display, proper merchandising, standard estimating, installation of more outlets, etc. Work will be done among the dealers, contractors and architects. The council will also urge manufacturers and jobbers to assist the dealers by the furnishing of advertising material and sales helps, and will urge the dealers to use such material.

While the beneficial effects will be felt largely by the electrical dealers and contractors, the manufacturers and the jobbers in increased sales, it is believed that the formation of the association will help the central stations to obtain fair treatment. With public prejudice operating against large central stations, it is probable that people will pay more attention to suggestions from business interests such as the electrical industry. At the same time, the tying-in of small electrical contractors and dealers with large central stations is expected to help their credit, give them better standing and improve the whole tone of the electrical business.

The British Columbia organization will endeavor to educate the contractor and dealer to help himself. It is not the intention of the association to conduct his business for him but to point out ways by which he may improve his service to the public and increase his own profits.

At the recent contractor-dealer convention in British Columbia the movement was emphasized in a speech by James Lightbody, publicity manager for the B. C. Electric Company, Vancouver.

"We must think of our business not in terms of more articles but as an idea—the electrical idea. That is what we have to get home to the public if we expect them to buy our goods. The idea has to be put across on a wholesale scale. The business in electrical devices has to be created out of nothing.

"The electrical business is not ready made. You must make it for yourself. It requires, therefore, the utmost care in the correct merchandising of your goods. It requires, moreover, the concerted efforts of all four factors in the industry. It is too big an idea to be put over by any one factor. It needs them all and it needs them all in cooperation.



The Electrical Supply Company, Ltd., of Vancouver, have one of the most attractive retail stores in western Canada. The owners state that "electric" and "service" are interchangeable terms in their vocabularies.

"The way each of you conducts your business instantly reflects upon the rest and vice versa. Poor advertising keeps back the whole industry. An untidy looking store makes the whole industry suffer. A smart store elevates the plane of all electrical merchandising. No man is a law unto himself in the electrical business any more than in ordinary life.

"Yet in propounding this doctrine we are not altruistic nor wholly selfish. It is all good business. The cooperative plan will put the electrical idea across in better shape and more quickly than any individual action.

"The manufacturers and jobbers and central stations all have men with organizing ability. The first moves must come from them. These companies should release men for no other purpose during the next year or two than organizing a cooperative movement in Vancouver."

Recommendations by the California Campaign

The Advisory Committee directing the California Electrical Cooperative Campaign has observed with interest the fact that other states are taking notice of the California idea and organizing movements similar to the California plan. It not only wishes to encourage the work, but is desirous of assisting so far as it can any of these movements, and with this end in view has prepared a bulletin with the following suggestions to supplement its regular reports:

1. We recommend to all cooperative organizations that they be supported by contribution from electrical firms and corporations rather than by appropriations from electrical associations. The contributions that we receive from the central stations, manufacturers and jobbers are all from the individual companies and corporations. The contractors and dealers contribute to our movement through their association, but we believe that even in the case of contractors and dealers it will be much more satisfactory to deal directly with the individuals. Movements similar to the California Electrical Cooperative Campaign are for the good of the entire electrical industry, have special missions to perform and should have no alliances that might in any way become entangling. The electrical associations in the territory should endorse the co-operative movement. In California the Pacific Coast Section of the N. E. L. A. from year to year passes a resolution endorsing our work and requests its members to renew their subscriptions to our fund.

2. Committees in charge of movements similar to ours should make their proceedings and activities informal rather than formal. We recommend neither a constitution nor by-laws. Experience has taught us that the problems of the electrical industry are constantly changing. We are dealing with problems today that were not contemplated or considered when our Campaign began. We feel that we have earned the confidence of the entire industry and are constantly receiving requests to undertake some new educational activity. We feel that a constitution and by-laws would have been a handicap to our work. In fact, we would probably have outlived our usefulness long ago if we had to conform to definite rules and regulations.

3. We recommend that an outline of policy be declared at the beginning, and that such policy be educational and not commercial. We analyzed problems of the industry in California and carefully wrote our declarations of policy before commencing any actual work. Statements of our policies will be found on pages 7, 8, 9, and 10 of our January, 1919, report and on page 3 of our January, 1920, report.

4. We would caution against proceeding too rapidly or attempting too much in the beginning. We proceeded slowly, feeling our way as we went, and this we believe has had much to do with the success of our Campaign. The first year of the Campaign in California was spent entirely in selling the co-operative idea. This was accomplished by dinner meetings and by our field men selling the cooperative idea before they attempted to any extent any other work. Even in the engaging of field men we proceeded with much caution. The duties of these field men are outlined in the reports of January, 1919, and January, 1920. As the work progressed an advertising representative was added to encourage and help the industry to tell its story through advertising and news items and to acquaint the newspaper editors and advertising managers with the possibilities and problems of the electrical industry. His duties are outlined in the January, 1920, report. The first of this last year an architectural representative was added to work with architects, builders and real estate men, explaining the advantages of adequate wiring and the necessity of providing a sufficient number of convenience outlets in homes. His duties are outlined in the January, 1920, report. Now the Campaign is ready to undertake educational work with industrials and establish lighting exhibits in San Francisco and Los Angeles. This illustrates how cautiously we proceeded and how normal has been the growth of the Campaign.

5. We have an unwritten law of undertaking no activity that has not the unanimous consent of all of our Committee. This has kept us from making any grave mistakes and from doing anything that might be detrimental to any branch of the industry and assuring us that our actions make for the good of the whole.

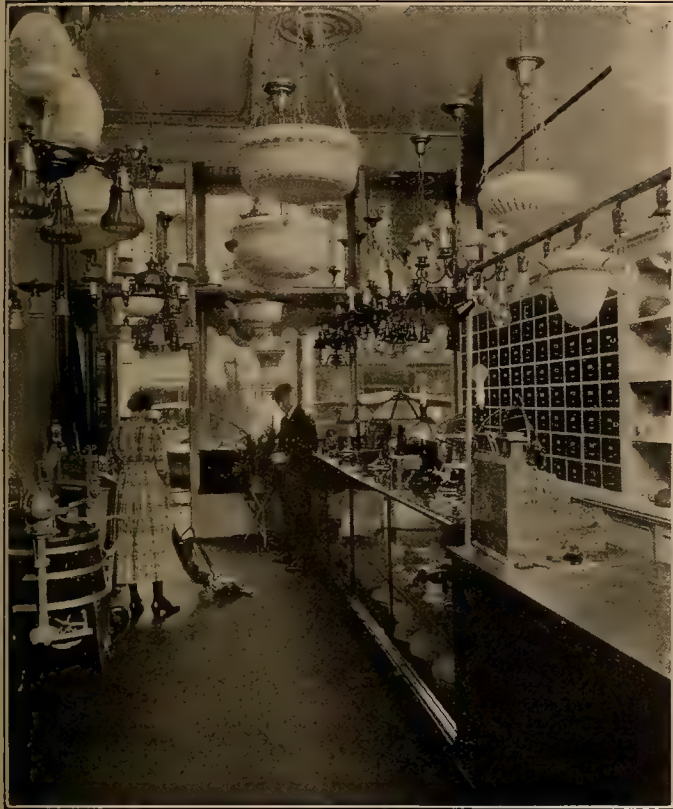
6. We recommend that the personnel of any committee similar to ours be changed as little as possible. It takes time for a man from one branch to grasp and understand the problems of the entire industry. Much useless discussion and going back over old ground can be avoided by a committee that is permanent in character, thus giving the committee more time for the discussion of constructive ideas and the actual solution of problems.

7. We never attempt to undertake any activity without the consent of the contributors. This we obtain by calling prominent men in various branches of the industry into our meetings and discussing the new problems with them. At all times we welcome their advice and any ideas that they may have to offer.

8. Contributors are kept informed of activities undertaken and results accomplished by monthly and yearly reports.

Contractor Dealers of the Northwest

(The advance in electrical retailing is one of the most marked features in the progress of the electrical industry. Below are interesting pictures of some of the up-to-date retail establishments in the Northwest which indicate the high standard of merchandising maintained by the contractor-dealer on the Pacific Coast.—The Editor.)



In the attractive store of F. A. Bauman & Company in Portland, washing machines and vacuum cleaners are conveniently placed for demonstration so that the customer who drops in to buy lamps does not have to make a special point of asking to inspect them. Notice the use of 'jewelers' cases for display, and the lamps of various types and intensities attached above the counter where they can be demonstrated easily.



A vista of display rooms opening one into another gives to the store of E. L. Wright & Company of Portland an air of distinction and spaciousness. This is enhanced by the tasteful arrangement of appliances on a long strip of plush at the left, and the general air of neatness in the entire display. Note the system of drawers at the right with a sample of the contents attached to the outside of each.



A polished table covered with a cloth provides a home-like setting for the table lamps displayed in the store of the Pierce Tomlinson Electric Company of Portland. Here also pamphlets invite the lingering customer. The counter is free of any kind of display, the smaller appliances being carefully ranged on shelves and in cases. The hanging fixtures are concentrated at the back of the store, leaving the walls and ceiling in the front clear.



Laying out a limited space to the best advantage necessitates a very skilful arrangement and absolute neatness. The Scott Electric Company of Portland has carefully distributed its heavier appliances, and made full use of all available shelf space to prevent crowding in show cases. Space economy is achieved also by locating the office department on a built-up "mezzanine floor."

Advertising

BY HOWARD W. ANGUS

(After you have bought your advertising space in the newspaper, what do you do with it? The preparation and placing of advertising copy are here taken up by the secretary of the California Electrical Cooperative Campaign in the third of a series of articles on electrical advertising.—The Editor.)

Having laid out your advertising program and schedule, the next point to consider is the preparation of your advertisement. Remember the four principles of salesmanship — attention, interest, desire, action. How are you going to secure them by your newspaper advertisement? First, your advertisement must be easy to read, therefore it should consist of plenty of white space so that the printed matter will stand out on the page like an island in a sea. If you fill it full of reading matter people will pass it by, because it is too hard to read. To get their interest it is necessary to have an illustration, and this illustration should be as large as your space will permit, because everybody's interest is aroused by pictures. These illustrations your manufacturers and jobbers will furnish you.

Now, how are you going to awaken their desire? Principally by having a short, brief, simple statement about the service the article will give the purchaser. Wrigley has said: "Say it briefly and keep saying it." Your statement should be in clear type that the eye may read it easily. Out of all this you want action, therefore be sure to have your name and your store location and telephone number in distinct and large type, that people may know where to buy. Those, in brief, are the cardinal points of an advertisement. Of course the larger your advertisement, the more unique its style, the more chances it has of being read.

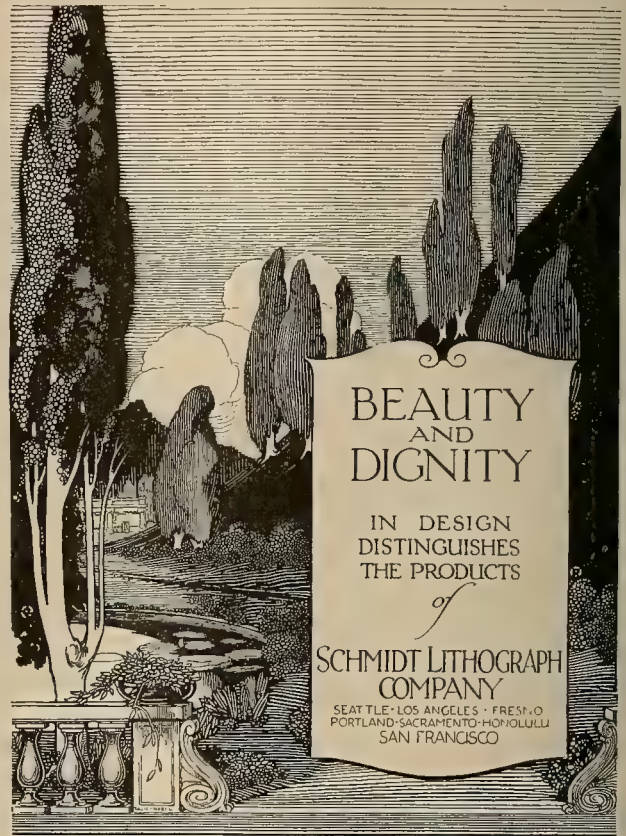
Preparing Advertising Copy

Newspaper advertising is a business in itself. You should master it, or better still, have some advertising agency or expert prepare your copy under your direction. You should not employ an agency, however, and leave the entire advertising to the agency. You know more about your business than the agent does. He knows more about advertising than you do. Combine the two. Give him your ideas and allow him to put them into advertising form. One of San Francisco's large public service companies has been running some unusual advertisements. They are written in rough form by the company's publicity writer who has ideas and knows his own business and what he has to sell. When you hire a salesman you hire him for his ability to sell electrical goods. Unless he is efficient you do not keep him. Certainly you should be as particular about the man who writes your advertising copy, and take as much pains with it as possible. To have it written by an office boy or scratched off hurriedly at the last minute is the depth of poor business.

Where to Put a Newspaper Advertisement

Having prepared your copy you ought to know where it is to appear in the newspaper. The best location is in the upper right hand corner of the first page. Of course you cannot secure that position.

No advertiser can. The next best location is in the upper right hand corner of any other page of the paper, especially on the odd numbered pages. That



An example of a dignified advertisement which sells the idea of possibilities in lithograph. Such an ad with a minimum of printing conveys a powerful message that will be remembered.

is where the eye naturally looks first. You should also pick your page. Next to the death column is not a good place for an advertisement, but contractor-dealers' advertisements have appeared there. The financial page is a poor page for an advertisement of any kind that is to go into the home, because few women read that page. It is a fine page, however, for an advertisement on industrial lighting, because business men and factory owners read it.

Before leaving newspaper advertising it might be well to explain the principles of the electrical page that is being promoted by the California Electrical Cooperative Campaign. People have acquired certain habits in reading newspapers, and the electrical page has been designed to fit in with those habits. The best way to illustrate what is meant is to consider how you read a newspaper. You read the first page always. After that you turn the newspaper over, scanning page after page until you come to something that interests you. As you scan the pages the big headlines across the top are certain to catch your eye. The electrical pages have a banner line that

states a fact about electricity, because we know that the majority of people will read that. As you look through the paper the next features that catch your eye are the pictures, therefore we try to get pictures on the electrical page. We are safe in saying that anybody who looks through a newspaper will at least

has stories. The department stores know that and have stories. The society columns of the newspaper are their publicity—telling all about what women wear and how homes are furnished. That's why the electrical industry must have publicity.

An electrical contractor-dealer, especially in the smaller cities, should form the habit of dropping in to see the newspaper editor. If you have wired a home and fitted it complete with electric appliances, write a story about it and carry it to the newspaper. Some of the best known men in the United States are so well known today, because they have religiously performed their duty of carrying copy to newspaper editors.

The principal features of a newspaper story are to state all the important facts in the first sentence and in every other sentence state a fact or elaborate on the facts in the first sentence. The story can then be cut anywhere after the first sentence and still tell the public what you want said.

TALKING TO A NATION BY WIRELESS

"This is Hiram Percy Maxim speaking from the De Forest radio telephone station at the California Theater, with aerial from the Humboldt Savings Bank Building, San Francisco."

This opening remark and the entire address which followed it were heard by owners—chiefly amateurs—of radio receiving sets all over the western United States. The address was delivered on July 3rd in connection with the programs planned by the California Theater, and the idea of having the theater's Sunday morning concerts "distributed" by radiophone.

It is significant of the rapidly-growing interest in wireless that there are already some 300,000 amateur radio sets in the United States, the owners being organized into a flourishing body known as the American Radio Relay League, of which Mr. Maxim is president. Mr. Maxim said in part:

"No one of the great multitude of human efforts being made at the present day can compare in far-reaching effect with radio communication. * * * At the great convention in San Francisco it was evident to the observer that assemblages of people have come to be of such vast proportions that no human voice is strong enough to be heard by all those present. Radio was called upon and a microphone installed and connected to amplifiers high up in the arena."

Mr. Maxim went on to paint a picture of the extension of this idea, describing the possibility of radio sets and amplifiers located all over the country in such a way that millions of people could hear one speaker at the same time.

"No one would be too remote to be able to listen. All he would need would be a radio receiving outfit, and we amateurs and professionals know how simple and inexpensive this would be. No code need be learned, for the spoken word would be the signal instead of the dot and dash. * * * This thing has a world of possibilities back of it. It points to the possibility of conventions being held at which the entire country may take part."

The beginnings of these developments are already apparent in such plans as that mentioned above, by which the concerts held every Sunday morning at the California Theater would be transmitted to hearers with wireless receiving sets many miles away.

Electrical Goods Have Big Place in Modern Homes

Servant Problem Solved as New Mechanical Power Wins Permanent Place in Family

Flourish Primary Care Taken of Home Labeled Nation From Various Countries Responsible of First Through Service to Millions of People, Said to Be Greater Factor of Happiness

BY LARRY LEVY



Washer Proves Drudgery Killer Various Uses of Another Appliance of Big Value

Electricity Does Much to Improve Home Conditions

Washing Machine Becomes Household Friend

Wall Plug Modern Working Companion

20 YEARS OF 1900 WILL Suggest Electrical Co.

EVERY WOMAN KNOWS THAT HER goodhousewife SHELF IS "A SHELF OF SMILES." GOOD CAN LIVE IN THE SAME HOUSE WITH A GOOD PERSONALITY IF IT IS A GOODHOUSEWIFE.

THE HOUSEWIFE KNOWS THAT QUALITY PLUS SERVICE EQUALS A HAPPY HOUSEHOLD.

SHE HAS LEARNED THIS LESSON: JENNIE REYES MUST BE GOOD OR THEY COULD NOT HAVE GROWN TO A MAILED YOUNG SO GREAT THAT TWO THIRDS OF THE ELECTRIC GOODS USED IN THE UNITED STATES TODAY ARE JENNIES.

BUY ELECTRICAL GOODS FROM YOUR ELECTRICAL DEALER

People Selecting Goods as Proper Christmas Gifts

Electric Goods Good Quality

Desires Same Safety as Better Luck

A LASTING GIFT That Will Be Appreciated

Electric Toasters Electric Kettles Electric Heaters

BYINGTON ELECTRIC CO. 1500 Fulton St.

For Christmas... A Eureka Cleaner

2nd Down and the Balance

Nathan Dohrmann

NOTICE Our Windows for Some Suggestions

Visit our Showrooms and we will gladly demonstrate

Electric Washing Machines, Sewing Machines, Vacuum Cleaners, Kitchen Gas and Electric Ranges, Cookers, Etc.

WATERHOUSE, W. W. 1010 Market Street

ROBERTS' DESIGNS LIGHTS

FLOOR Lamps, Table Lamps, etc.

Electric Company San Francisco

A solid electrical page which appeared in a Sunday paper. In a week day edition other news should appear on the page but on a Sunday the reader of the paper has more time and will usually give such a page plenty of attention.

catch the headline and the picture. After that the next thing you read are the stories. The last things you read are the advertisements, unless they fairly jump out of the page at you. Therefore, we have stories with headings to them in type large enough to catch the eye of the man who scans. These again state a fact about electric appliances and service. There is a danger that people once having read the electrical page may merely read the headlines and then pass it over. For that reason the newspapers have been encouraged to put real, live news stories on that page along with the electrical items, so that the public will dip into the page to read these stories and run across the electrical stories that are alongside of them; the idea being that the headlines, pictures and stories will sell the electrical idea and the readers will look at the advertisements to find where to buy. To give percentages, 95% of the readers of a newspaper will look at the headlines and illustrations, 50% will look at the big type at the head of the stories, over 15% will glance over at least one of the stories, 5% at least should look at the advertisements. So you see that inasmuch as in buying newspaper space you are buying readers, the advantage of the electrical section is a gain of from 20% to 90% in readers alone. The smaller the newspaper, the larger are all the percentages.

Stories on the goods that merchants sell are necessary. The automobile industry knows that and has stories. The theatrical industry knows that and

What Is the Business Outlook?

(How the present abnormal business situation, with its high prices for labor and materials, its restricted credit, affects the electrical industry is brought out in the following interesting compilation of letters from prominent electrical manufacturers, written in response to inquiries sent out by the Journal of Electricity.—The Editor.)

At the present time with the cost of living, building and all materials still on the increase, or at least maintaining their present inflated state, it is of great interest to know just how the large manufacturers feel about the present business outlook. Accordingly a number of them were consulted with the idea of securing some data that would prove of value to the rest of the industry. From the optimistic tone that prevails in all of their reports it is certain that the electrical industry is at the present time on a firm footing, with every indication that it will continue to be so and that the gradual recession of high prices will come slowly enough and with plenty of warning so that no one will be injured.

D. Hayes Murphy, American Wiremold Co. of Hartford, Conn., says: "The supply has increased somewhat and while the demand is still good it is not as urgent as during the spring and winter months. With the distinct shortage of most classes of buildings and all classes of railroad equipment, it seems reasonable to expect a long period of satisfactory business with occasional recessions for the adjustment of prices and credits."

That the Habirshaw Electric Cable Co. of New York are confident of the stability of business is shown by the following from J. Nelson Shreve: "We do not look for any changes at the present time in the price of copper. There is no heavy buying of copper now and the producers are not very anxious to sell. They expect the buying movement in August and look for an increase in price about then which we do not consider a justified expectation until the financial situation lets up, which we believe will be in the near future. Business continues on a very large scale here and we believe that it is going to keep up."

The manufacturer of conduit is optimistic as to the general business prospects in the electrical industry for the balance of the year, according to C. E. Corrigan, vice-president of the National Metal Molding Co., for the following reasons:

"1. Because of restricted production for the many reasons well known, there is no accumulated supply of products which we manufacture at any point—either at our plant, our warehouses, or in the stocks of our distributors or their customers. That the demand for electrical materials for the wiring of buildings will not decrease for the balance of the year appears to us certain, because from our observation the demand for the past several months of this year for these materials has been for smaller construction—building of residences, garages, repair work and factory extensions—but there is evidence present now of the starting up of erection of office buildings, hotel buildings, and such other structures as will rather increase than lessen the demand for electrical materials.

"2. There does not seem to be any indication at present of lowering of prices, because costs of production are not being lessened either on the item of labor or raw materials.

"3. The chief difficulty of manufacture today is the shortage of cars in which to make shipments and which cannot be relieved until new cars are built, which takes time. There is also difficulty in getting raw materials, which is largely attributable to the same cause, viz., shortage of cars in which to make shipments. Labor conditions are improving so far as the supply is concerned.

"In conclusion, we believe there is an increasing feeling of optimism among business men and manufacturers, and notwithstanding a large portion of the balance of the year covers a period of the presidential campaign, the major conditions point towards general improvement in all conditions that make for prosperity."

George A. Hughes, president of the Edison Electric Appliance Co., looks for a great expansion of the appliance business:

"We have been passing through a period of expansion of general business apparently greater than normal, and a period of contraction may naturally be expected.

"The readjustment of general business conditions, however, ought to prove of benefit to the electrical industry by releasing funds for investment in the central station field which is now suffering because of high money rates and stringency of the money market.

"We have reached a new age—the electric age—which involves our domestic habits. There is a tremendous potential demand for electrical appliances which properly directed sales activity will continue to turn into increasing actual demand; and the natural expansion of the appliance market will more than offset, in our judgment, the influence of any period of general business contraction."

The manufacturer of wiring devices states that "nothing short of an industrial catastrophe could by any possibility check the growth of the electrical industry." To go on quoting P. A. Powers, advertising manager, Benjamin Electric Manufacturing Co.:

"The electrical industry, particularly that concerning the manufacturers of industrial, household and farm lighting devices and appliances, is in an immature state of development. The possible market which can be stimulated exceeds at the present by several times the ability of electrical manufacturers to supply it. To those manufacturers who are developing lines of material for these markets the outlook is promising. Nothing short of an industrial catastrophe could by any possibility check growth. We do not expect industrial stagnation; quite the contrary. In our opinion, therefore, manufacturers should view the future with considerable confidence."

Another manufacturer of wiring devices, The Bryant Electric Co., has confidence in the future of the electrical wiring device business, as is shown by the statement by F. V. Burton, general manager of the company:

"I suppose it has never been so difficult as now to forecast the future of the wiring device market, or any other market, for that matter.

"In general, I think it can be said that it is entirely dependent on how the railroads solve their difficulties. We have plenty of unfilled orders and they continue to come in at least as fast as we can ship out. The demand for all kinds of buildings—and especially of living quarters—is so great that except for some adverse influence we feel that our demand will continue and increase. It takes more and more emergency efforts, however, to get raw material in and to get it to our distributors after we get it manufactured."

John J. Gibson, manager supply department, Westinghouse Electric & Manufacturing Co., one of the largest manufacturers of electrical equipment in the United States, has summed up the present condition of the electrical industry in a manner that leaves little doubt as to the future growth of that industry:

"It is very difficult to express an opinion just at this time without running the risk of being misunderstood. I believe everyone in the industry is an enthusiastic optimist on the future in general, but at the same time every observing man cannot fail to see that the present situation contains certain elements of uncertainty which will sooner or later result in business depression of a more or less temporary nature.

"As to the immediate conditions, the copper market is strong. This is evidenced by the lack of any appreciable effect on copper prices by the large quantity of copper which came recently on the market through second-hand channels, due to the Japanese financial trouble, which prevented copper exports to Japan, coupled with the inability of the exporters to finance the carrying of these large amounts thus thrown back on their hands.

"Costs are still pushing prices up. The volume of orders keeps up, but the percentage curve of increase this month over last month and this year over last year is flattening out.

"Lack of adequate transportation, tightness of money, and shortage of material, annoying and paralyzing as they are, may ultimately be found to have been blessings in disguise, for they are restraining influences which will prevent over-inflation which would be very disastrous.

"The volume of business in the smaller articles in the industry, particularly those things handled by electrical jobbers, depends upon two things—building operations, and the spending power of the great buying public. Building operations are falling off in volume, but the effect of this will not be felt for several months in the jobbing business.

"In the central station branch of the industry the demand for meters and transformers, particularly meters, is far beyond the combined capacity of manufacturers thereof.

"In the industrial field, in many industries manufacture is slowing down, notably in the textile and automobile trades.

"In the domestic field buying is still good and will remain so as long as people have money to spend. This will continue until there is unemployment. Here is where our educational campaigns may be counted upon to overcome any depressing causes due to general conditions, and those parts of the country fully electrified, of which California is the most conspicuous example, will probably feel no change at all.

"We may all congratulate ourselves on one thing, and that is that the electrical industry never feels any depressions as much as other industries. It is the art conservative of all arts—the industry of economy and saving, and the wonderful campaign of education which has been carried on by the electrical fraternity will keep electrical business always on the up-grade of growth and development. Also two general matters are strong factors in favor of electrical growth: one is the high cost of fuel, and the other is the fairer and ever more favorable attitude of the public towards public utilities. Ultimate success and profit are sure for every branch of the electrical industry."

H. A. Lewis, advertising director of the Electrical Trio, McGraw-Hill Co., has given his ideas on present business conditions as follows:

"At the present time the country is going through a period of credit deflation brought about by the action of the Federal Reserve Board, the action of the latter being a natural consequence of the twenty-six billion dollars' worth of government loans floated as a result of the war for which we have, as a nation, no physical assets to show. Based not only on conditions from the viewpoint of the electrical trade but also the automobile trade and other businesses, the question of restricted credit will be with us for some time, but by Fall the bankers will have eliminated many of the speculative commitments, particularly for commodities.

"Labor conditions at the present time have, in the judgment of certain thinking people, turned the corner for the better. The cost of living has reached its peak and as living prices will not go higher, neither will labor prices.

"Raw materials for electrical industry are tied up primarily by this question of transportation and no manufacturer can expect to see a smooth movement of raw materials, nor can any jobber or dealer expect to get stock regularly until well into the Fall or early Winter. Weather conditions this Fall and Winter will have a direct bearing on the movement of raw materials and finished products.

"There is no doubt that the consumer demand in many lines has softened. This applies particularly to household devices and also wiring material as a result of delayed building activities. Offsetting this, however, is the fact that we have no surplus stocks of either household devices or wiring supplies so that there will be some months before production and distribution will catch up to the so-called consumer demand.

"At the present time, the most optimistic single fact of the situation is the growing consciousness on the part of the consuming public that price cutting sales in the early summer were abortive. The public, as a whole, is beginning to see that there can be no drastic reduction in prices and such reductions which take place will come gradually and as a result of increased production. While in some lines abnormal profits have been made and large quantities of stocks held for speculative purposes, in the aggregate there is no surplus, so the prices have direct relationship to the cost of materials and cost of labor.

"The most outstanding factor which will help to soften the prices will be the importation of European and Japanese merchandise, because as the foreign countries increase their production, the rates of exchange as they exist today work very much in favor of the American importer.

"There was never a time in the history of American politics when the presidential election was as largely discounted as today. As a factor in general business, it has almost no bearing.

"In my personal judgment, we can expect a more optimistic tone in business this Fall, and I think the electrical industry particularly will have a decided revival of buying, particularly in those lines which are for general consumption."

The manufacturer of washing machines, vacuum cleaners and ironing machines has the brightest hopes for the future, as is shown by the following statements of Neil C. Hurley, president of the Hurley Machine Co., Chicago:

"A careful analysis shows us nothing but splendid business ahead in electrical labor saving devices for the home. There seems to be no let-up in the demand for washing machines, ironing machines and vacuum cleaners. Our shipments for the first six months of 1920 are 149% more than they were for the first six months of 1919.

"I think that Chicago is a rather typical market, and certainly business has been going ahead here at a rate exceeding the best business that we have known heretofore. Dealers who have a good window display and who keep the salesmen on their toes are still clamoring for merchandise that they cannot get. It is only in those towns where dealers let business take care of itself that it has fallen off.

"We have the same optimistic view of the future that we have held for the past fourteen years. We have not been wrong yet and we know that we are not wrong this time.

"We know that clothes must be washed, we know that there are no servants to wash them and we know that housewives are not going to do this work themselves. They are going to buy machines when machines are available, so we know that jobbers and dealers are going to continue to sell these products.

"We believe that the jobber and dealer who is not organizing properly and looking forward to this particular branch of his business is losing a wonderful opportunity.

"Here are some cold bare facts on the immigration of women into the United States since 1910:

1910	269,444
1914	370,594
1919	10,428

"Think of only 10,428 women servants having arrived in America in 1919. This was only one servant for every 2000 families. Think of one servant in a town of 10,000 inhabitants and you have some idea of the picture. While there was an improvement in immigration in January and February of this year, it is believed that this improvement has been counteracted by the return of thousands of people during the past few months.

"Then you must take into consideration the shortage of homes in the country. This applies to almost every city in the United States, large or small. It is going to take them from five to ten years to get anywhere near normal, and no matter how high-priced labor and material may be, people will find out by next year or the year after that it will be absolutely necessary for them to build homes, apartments, etc., to take care of the present householders.

"There has been a tightness of money that has made some people feel that business was going to get poor later on and prices would come down, and that they could not get money to pay for materials, etc. I took this matter up with several of the banks in Chicago and New York and they all told me they would furnish all the money that was necessary for any good going business and that no one need hesitate about going ahead because he was short of money.

"The president of one of the largest and most important banks in Chicago said: 'Bankers are going to see to it that legitimate manufacturers, jobbers and dealers have enough money to carry on business. There is going to be no tightness of money where straightforward business is concerned. Bankers do not like to make loans to individuals so that individuals may buy luxuries—both dress and household—or to speculate. Because bankers have stopped this sort of loaning the idea has gotten around that money is tight. But any regular business man can get money whenever he needs it.'

"That is the spirit which I have found existing among all bankers. The Federal Reserve Bank System has made panics almost impossible as long as the government itself has money. And there is no prospect of the government being out of money, as you know.

"We do not think that material will go much higher, but there is no chance for it to come down on account of the high cost of labor and we do not look for any reduction in labor this year or next. We believe as long as labor prices stay up the other prices will stay up accordingly.

"Labor-saving devices for the home should never be classed as luxuries. They are altogether different from automobiles, which people buy for pleasure, and things of that kind which they can get along without. It is impossible today for a well managed house not to have electric labor-savers in it. Besides the labor saved by a washing machine there is a saving on the clothes. The high price of linens and all washable goods have made the housewives more careful about saving them from wear. In the old days when linens were cheap they did not watch them very carefully and allowed washwomen to rub them to pieces on the washboard, but today they are taking into consideration that their linens will last from six to eight times longer if washed in a washing machine. This amounts to a great deal of money and in fact will pay for a washing machine in a very short time.

"The whole world is short of goods and material and it will take years to replace what was lost. We could sell our entire output in England if we wished to ship it abroad. The American Exchange National Bank in their report of July 1, 1920, say that the foreign demand for American goods as revealed in the report of the Secretary of Commerce for May shows no sign of abatement.

"This is not a good time for any of us to feel that there is going to be a let-up in business along the lines we manufacture. I hope that none of the jobbers will feel that they should not go ahead stronger than ever in organizing their dealers and having them push these labor-saving devices as they should.

"But the dealers and jobbers who are going to get the most out of this good business, which is bound to remain with us, can do so only by using their foresight, anticipating the demand and ordering months in advance."

COMING CONVENTIONS

Are you considering—

The Northwest Electric Light and Power Association Convention?

Parties are being made up at various points along the Pacific Coast to attend this thirteenth annual convention of the Association, which is to be held in Spokane, Washington, September 8-11.

The program is given on another page of this issue of the Journal of Electricity.

State Chapters of the American Association of Engineers —

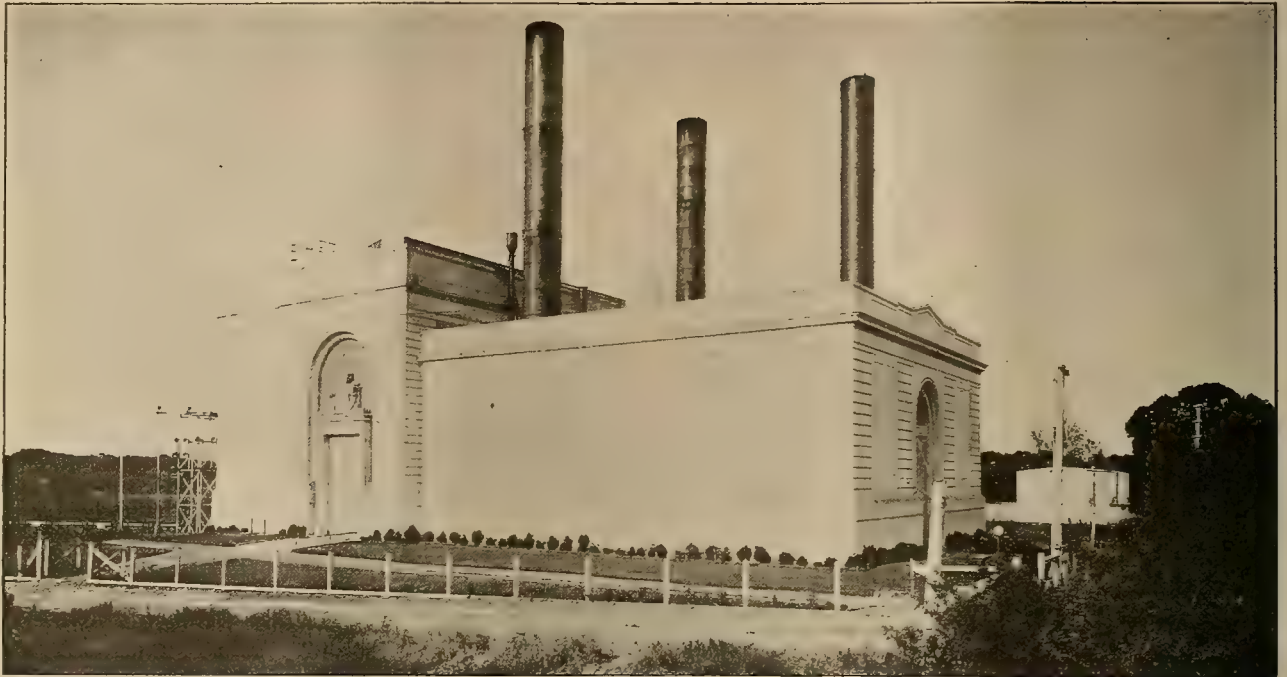
Everett, Washington, August 24

National Association of Electrical Contractors and Dealers —

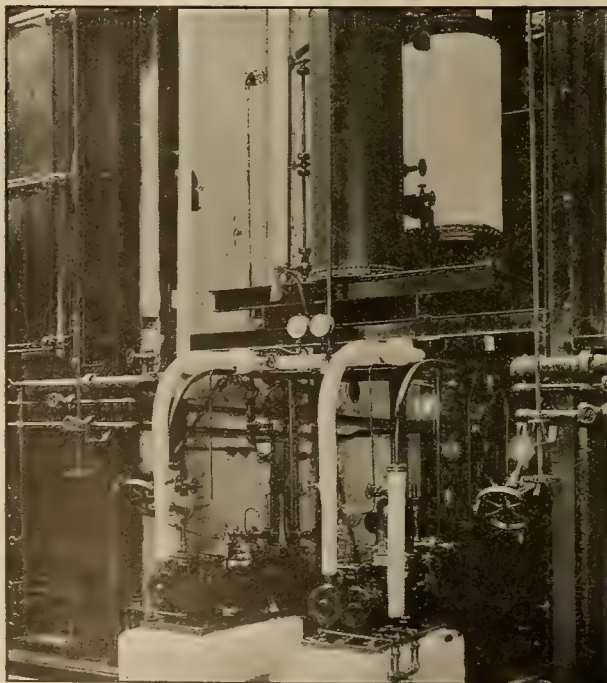
Baltimore, Maryland, October 4-9

Features of Steam Power Plant Practice in the West

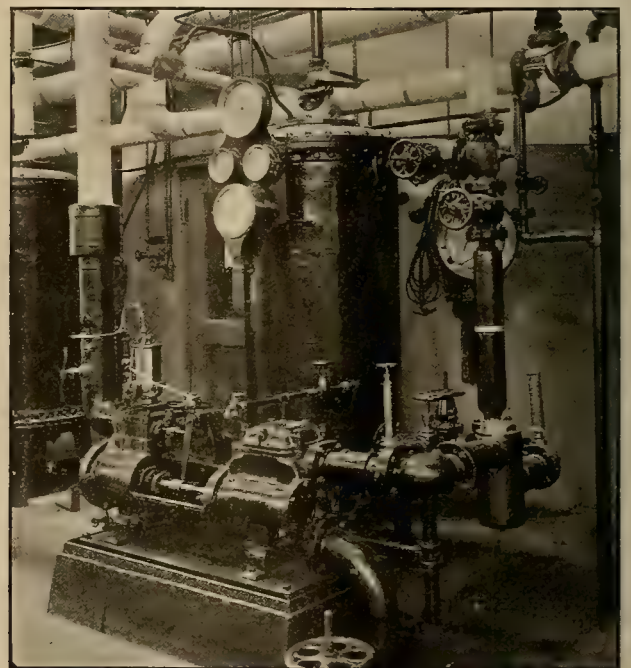
(The rising costs of fuel oil demand each day closer inspection in steam power plant operation in the West, and bring forth an insistent call for increasing economies in steam generation. Here are some views that show interesting features in recent steam power plant installations which are making possible the unusual economies brought out in the West in installations of this nature.—The Editor.)



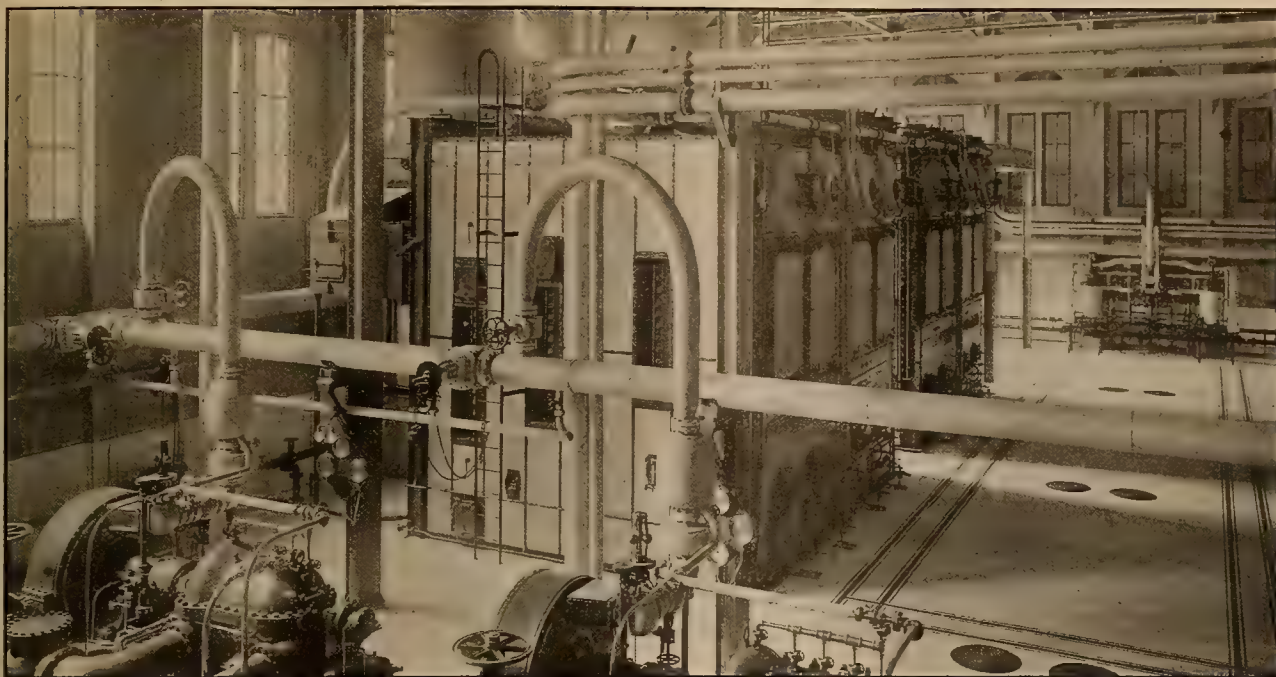
5,000-kw. steam turbine station, oil burning, Pacific Gas & Electric Co., Sacramento, California. Standby plants of this nature viewed in connection with hydroelectric network afford unusual opportunities for aesthetic design in exterior, as shown in this view.



Fuel oil pumps and heaters, Pacific Gas & Electric Company, Station C, Oakland. Below are shown the duplicate reciprocating fuel oil pumps. Above is a large air receiver and a coil pipe oil heater.



One unit of a duplicate set in the Long Beach steam plant of the Southern California Edison Company, consisting of a fuel oil pump in the foreground with the oil heater immediately behind it.

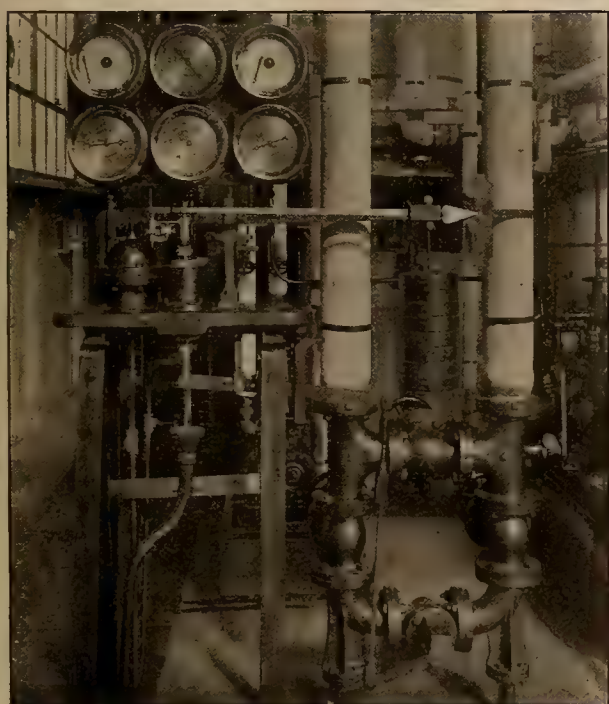


Above: High pressure pumping station of the San Francisco Fire Department. This plant is designed for standby operation and is at all times ready to prevent another fire of the magnitude of that which swept San Francisco in 1906. A feature of installations of this type is that they are one-man plants.

Exterior view of San Bernardino Plant of Southern Sierras Power Company where artificial draft is employed is shown to the right.



Below to the left may be observed oil-to-burner Mocre regulator controlling the steam pressure and the oil pressure, while on the right may be seen the damper controller that works by hydraulic actuation at the Arizona Power Company, Phoenix, Arizona.



Problem Course in Electricity

BY H. H. BLISS

(In the ordinary applications of electric power practically all devices are connected in multiple. This paper, the fourth in this series on practical electricity, deals with the difficulties found in calculating volts, amperes and ohms in these circuits. Answers to the problems will be published in the next issue of the Journal of Electricity.—The Editor.)

MULTIPLE CIRCUITS

Division of Current.—When an electric current comes to a point where the circuit splits into two or more branches, the current divides, part flowing in each branch, to be reunited at the next junction. The branches are said to be “in parallel” or “in multiple” with each other, and any one is called a “shunt” with reference to the others.

This discussion deals with circuits carrying direct current. Alternating currents obey the same



Fig. A

In this diagram a generator is shown impressing 120 volts on two parallel circuits, one of 40 ohms and the other of 24 ohms.

laws unless the circuits contain coils or condensers; hence the lamps and heaters considered below may be supplied with either direct or alternating current.

In calculating with divided circuits one has to keep in mind Ohm's Law and the following three facts: The total current is the sum of the branch currents; the pressure is the same across all the branches with the same terminals; the resistance to the current is less when it can divide and flow through several paths than when it is confined to one of them.

To determine the amperes in any branch, one simply divides the pressure across it by the resistance of that branch. In Fig. A, for example, the generator impresses 120 volts on two parallel circuits, one of 40 ohms and the other of 24 ohms. Currents are respectively $120/40 = 3$, and $120/24 = 5$ amperes. The generator evidently supplies a total of 8 amperes.

Equivalent Resistance.—This is the current which 120 volts would send through a single resistance of 15 ohms ($120/8 = 15$), and hence we may say that the “equivalent resistance” of the two parallel branches is 15 ohms. There are several ways to calculate the equivalent resistance of parallel resistances, all giving the same answer:

(1) Divide the actual voltage across the branches by the resistances, thus determining the respective currents. Add these, and divide the voltage by the combined current. (This method used above.)

(2) Instead of using the actual voltage, assume any voltage that seems convenient—generally one volt is selected. Then proceed as above. For the example of the 40 and 24 ohms the currents are $1/40 = .025$ and $1/24 = .0417$ ampere; sum = .0667 ampere. Resistance = $1/.0667 = 15$ ohms.

(3) Use the rule: “Equivalent resistance = product of separate resistances divided by their sum.” With this example the rule gives $40 \times 24/64 = 15$ ohms.

(4) Draw, at any convenient distance apart, two parallel vertical lines whose length represents (to some scale) the separate resistances. Draw dotted lines from the top of each to the foot of the other. A vertical dropped to the base line from the intersection of the dotted lines indicates (to the same scale) the number of ohms of equivalent resistance. Fig. B shows the construction for 4 ohms and 12 ohms in multiple. Here $1/4$ of the length of the line at the right represents 1 ohm, and the resulting vertical has a length of three of these units. Hence the answer is 3 ohms.

(5) The quickest way is to use an “alignment chart” such as that in Fig. C. For instance, with 4 and 12 ohms in multiple hold a straight edge from the mark “4” on one of the outer lines to the mark “12” on the other. The equivalent resistance is read at the crossing of the center line as 3 ohms. With this chart it is sometimes necessary to read between the marks; for instance, with 2.3 ohms in parallel

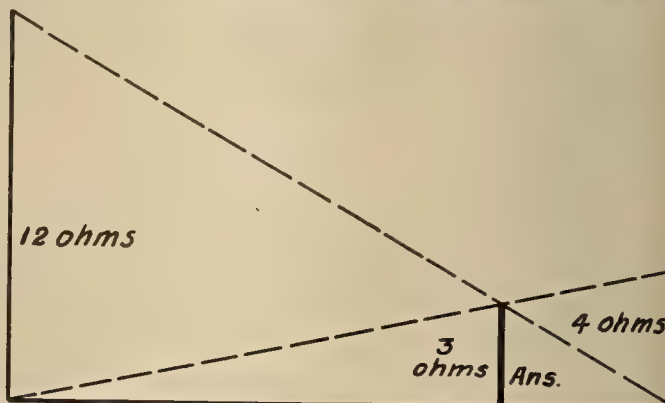


Fig. B.

The above shows how the equivalent resistance of parallel resistances may be found by constructing right triangles to represent the parallel circuits and then dropping a vertical line from the point of their intersection.

with 3.7 ohms, the answer (1.42) requires some estimating of spaces by eye. For large numbers, as 24 and 40 ohms in multiple, it is best to divide mentally by 10 and get the answer for 2.4 and 4 ohms (1.5 from the chart), and then multiply mentally by 10, getting 15 ohms as the equivalent resistance.

Three or More Branches.—Imagine a 120-volt generator feeding three parallel circuits, of 12, 20 and 30 ohms respectively. What is the combined resistance? The currents are 10, 6 and 4 amperes; total = 20. Equivalent resistance = volts applied \div total current = $120/20 = 6$ ohms.

The same result is obtained by assuming 1 volt applied and proceeding according to method 2. With any of the other methods it is necessary to figure with two of the resistances, and then to combine this result with the third resistance. For example, using the fifth scheme, get the combined resistance of 20 and 30 ohms (2 and 3 in parallel give 1.2 hence 20 and 30 give 12 ohms), and combine this with the third resistance (12 ohms), finally arriving at the answer, 6 ohms.

Equal Resistances.—If two 60 ohm lamps are in multiple, their combined resistance is found by any

one of the five methods to be exactly half of 60, or 30 ohms. If three are in parallel, the equivalent resistance is $1/3$ of 60, or 20 ohms. Four in parallel are found to give 15, five in parallel 12, etc. In general the equivalent resistance of any number of equal resistances connected in multiple is equal to the ohms of one divided by the number of parallel branches.

Solutions of Series Circuit Problems

23. Ohms per foot = .103; for 670 ft., $670 \times .103 = 69$ ohms.

24. Each lamp carries 6.6 amperes. Each has a resistance of $37/6.6 = 5.6$ ohms; 50 have 280 ohms. The circuit has $1880/6.6 = 285$ ohms; hence the line has a total of 5 ohms.

25. Ohms in 230 ft. = $4/8.7 = .46$; ohms per ft. = $.46/230 = .002$; ohms per 1000 ft. = 2.0.

26. Total resistance needed = $215/6.7 = 32.1$ ohms. $32.1 - 8.5 = 23.6$ ohms, which must be put in series.

27. Current = $218/(202 + 475) = .322$ amp. Volts across first lamp = $.322 \times 202 = 65$; across other = 153. The first lamp will be very dim; the other very bright, soon burning out.

29. Line resistance = $50/67.2 = .744$ ohm. Then $.744/.248 = 3$, indicating 3000 ft. of wire. Distance = 1500 ft.

30. Resistance in shaft (2 wires) = $1.4 \times .02 = .028$; of trolley wire ohms = $1.6 \times .05 = .080$; of track = $1.6 \times .01 = .016$; total ohms between generator and train = .124. Drop $\times 130 \times .124 = 16.1$ volts; generator volts = 230.1.

31. Current = .021 ampere; drop in lamps = 10.5 volts; 105 volts applied to man. Note that .1 ampere may be dangerous and .25 ampere fatal. One's best protection from shock is in the resistance of dry skin; lamps, fuses, etc., are no protection.

32. Resistance = 4 volts/140 amperes = .0286 ohm. Drop at 30 and 200 amperes = .86 and 5.72 respectively, hence voltages required are 116.86 and 121.72.

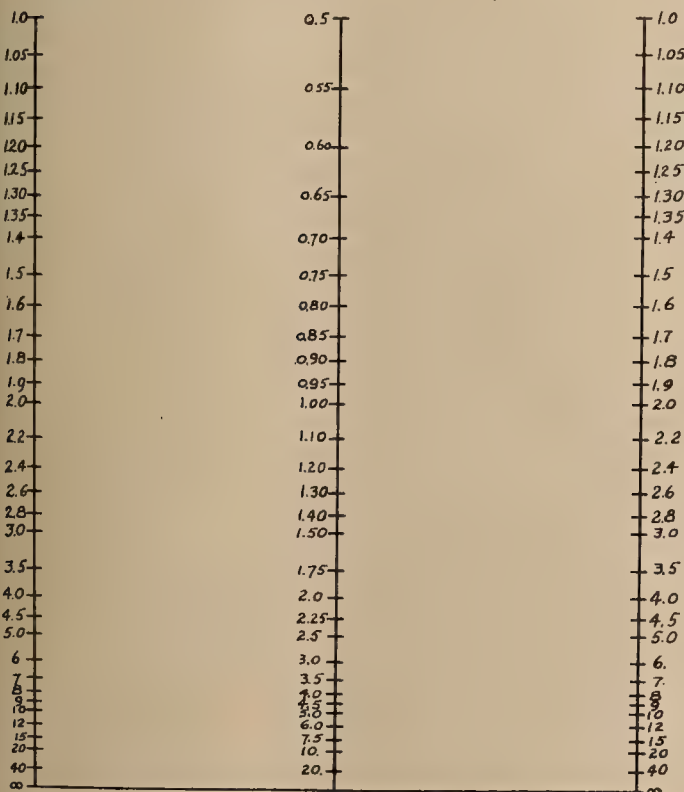


Fig. C

The quickest way of finding the equivalent resistance of parallel resistances is to use an "alignment chart" such as the one shown above. A straight edge is held so as to pass through the points representing the two parallel resistances as marked on the two outer columns. This will pass through a point on the middle column representing the equivalent resistance.

Problems on Multiple Circuits

33. A 92 ohm lamp is in multiple with a 24 ohm heater. If the lamp takes a current of 1.25 amperes, what current flows in the line?

34. In a single lighting fixture used on a 110 volt circuit there are five 25 watt lamps in parallel. Each has 485 ohms. What is the equivalent resistance of the group, and what current comes to it?

35. An ammeter of .01 ohm resistance has a "shunt" of .0025 ohm connected in multiple with it. What is the combined resistance, and what is the current in the line when the meter carries 12 amperes?

36. Two coils, of 7 and 29 ohms respectively, are connected in series, and the pair is shunted by a third coil of 18 ohms. What is the current in the line when the 7 ohm coil takes 2.5 amperes?

37. Three coils in a curtain heater are in multiple; coil A has 30 ohms and takes a current of 3.6 amperes; coil B has 24 ohms and coil C takes 2.7 amperes. Find total current and the equivalent resistance.

38. Two lamps in parallel take a total of 3.6 amperes at 108 volts, one lamp getting 2.1 amperes. The line wires between the generator and the lamps have .8 ohm resistance each. Find the current in the second lamp and the generator voltage.

39. What is the resistance of each of the lamps of Prob. 38? What is the resistance of the entire circuit outside the generator?

40. An electric locomotive taking 130 amperes is fed through a trolley wire 1500 ft. long which has a parallel feeder of equal length. The resistances are respectively .062 and .030 ohm per thousand feet. The return circuit (track) has .014 ohm per thousand feet. What is the voltage drop between generator and locomotive?

41. Lamps A and B of 160 ohms each are connected in series across a 120 volt circuit. A voltmeter is connected to the terminals of lamp B. What does it read? What does the reading become if a third lamp (160 ohms) is connected in multiple with lamp A?

42. A 220 volt heater, which takes 4 amperes on "high heat," 2.75 on "medium" and .86 on "low heat," has but two coils, one of which is used alone for the medium heat. Explain the connection for "high" and "low," and calculate resistances of both coils.

43. An electromagnet (16 ohms) and an electric toaster (35 ohms) are connected in multiple, and a resistance grid (4 ohms) is in series with the pair. An electric heater of 22.5 ohms is connected in shunt across the rest of the apparatus. Find the equivalent resistance of the whole combination.

44. At a telephone central office an operator's lamp circuit contains the following articles, all in series: A 24 volt battery, a lamp, a resistance coil of 83 ohms and a relay coil of 37 ohms. What is the lamp resistance if it takes .1 ampere? Find the circuit resistance (outside the battery) when a 40 ohm shunt is connected in multiple with the lamp.

45. A man whose body resistance is 6000 ohms connects three 1200 ohm lamps in series across a 221-volt circuit. To get a medicinal shock he connects himself in multiple with the center lamp. What current flows through him? What if the center lamp burns out while he is enjoying his shock?

ELECTRIC WIRE TO BE MANUFACTURED IN JAPAN ACCORDING TO NEW STANDARDS

Ten leading electric wire manufacturing concerns in Japan, according to an issue of the Trans-Pacific, have recently issued a joint statement to the effect that they have completed their preparations for the production of insulated electric wires and cords to meet the official standards published last October. The manufacture of the old type wires and cords which have until this time been used in Japan will now be discontinued.

Mechanical Analogs—II.

BY G. R. SCHUCK

(The second of the series of mechanical analogs, by a member of the electrical engineering department of the University of Washington, takes up the parallel pressure and flow processes of mechanical and electrical circuits.—The Editor.)

RESISTANCE, CAPACITY AND INDUCTANCE IN PARALLEL

In the system shown in Fig. 3, T and T_1 are tanks connected by pipes to a cylinder K which contains a piston oscillating as does the piston of a steam engine. Connected as shown in the figure is a cylindrical vessel (C) divided into two parts, A and B , by an elastic partition M made of rubber, or some other elastic material. L is a similar vessel with the exception that the partition D is a massive piston free to move to the right or left without appreciable friction

the elastic membrane is subjected to a pressure from (A) causing it to stretch into shape shown in dotted lines. This stretching of the membrane allows a flow of liquid into receptacle A , thru F_1 and W_1 . A half period later the membrane will be stretched in the other direction allowing a similar flow of liquid into B , through F and W . A surging of liquid back and forth occurs, periodically varying, as does the pressure. It should be emphasized that when the rate of flow is maximum, the pressure is zero and when the rate of flow is zero the pressure is maximum, because the flow has ceased when the

membrane is stretched to its maximum position, at which time the pressure is at a maximum. Furthermore, when the pressure is at a maximum in tank T , and just starts to decrease, the flow of fluid will be

cycle, counting time from left to right, it is found that the pressure curve lags behind the flow curve one-fourth period or cycle.

In Fig. 5, K is a source of alternating current which supplies electrical pressure to C_1 a condenser; L_1 an inductance coil; and R_1 a non-inductive resistance. Let the wave of electromotive force of K be repretoward this tank T , and negative with respect to the pressure in T . Therefore to draw the curve of fluid flow in circuit C , start at the point b and draw a curve I_c downward so that the **maximum** and **zero** values of flow will coincide with **zero** and **maximum** of pressure respectively. Now if the curves are followed through one

sent by the same curve E of fluid pressure, Fig. 4. Close the switch which controls circuit C_1 . When the voltage is a maximum as at b the charge into the condenser is a maximum and the current has ceased to flow and is zero. An instant after the time (b) the voltage decreases, releasing the charge on the condenser, causing a current to flow in a direction opposed to the voltage decreases. Therefore, from the foregoing, it is evident that the curve of current will start at b and be drawn downward and will coincide with the curve of fluid flow I_c , Fig. 4, which hereafter in this article will represent fluid flow in C and amperes in C_1 . Hence it is shown that an alternating current leads the impressed voltage lags by a quarter period, or expressed in other words, the impressed voltage lags behind the current of a condenser circuit one-quarter period, or ninety degrees.

Referring again to Fig. 3, close all the valves except the one which controls the flow into vessel L , and study the effect which the alternating fluid pres-

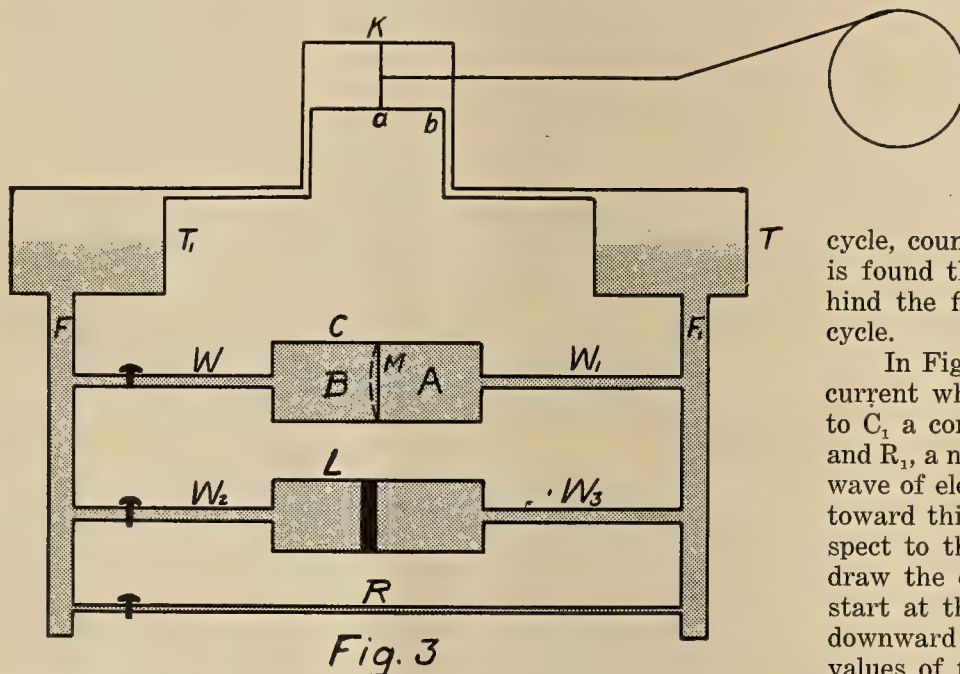


Diagram of mechanical equipment to illustrate relation of pressure to flow.

and having much inertia. R is a small pipe having long length and small cross section area. Valves are inserted in the pipes W , W_2 , and R . The whole system, including only half the tanks T and T_1 , is filled with some incompressible fluid without inertia. The upper halves of the tanks and the piston are filled with some incompressible gas, such as air.

When the piston in cylinder K oscillates back and forth, there is produced a difference of pressure in the two tanks T and T_1 , first in one direction, then in another. The curve of pressure for one complete cycle of the piston is represented by E in Fig. 4, time is counted from left to right. That portion of the curve above the line represents the excess of pressure in tank T and the lower portion of the curve the excess in pressure in T_1 . With all other valves closed, open the two which connect to vessel (C). When the piston is moving from position (a) to the right the pressure in T increases over that in T_1 as shown in the first part of curve from (a) to (b);

sure has on the rate of flow and its time relation with the latter. Assume that the massive disk M is moving to the right and passing through the neutral position at the instant the water pressure is starting to increase in A . This increasing pressure in A exerts a retarding effect on M , and stops its motion at the instant when the fluid pressure has reached its maximum value (at b on the curve), Fig. 4. The

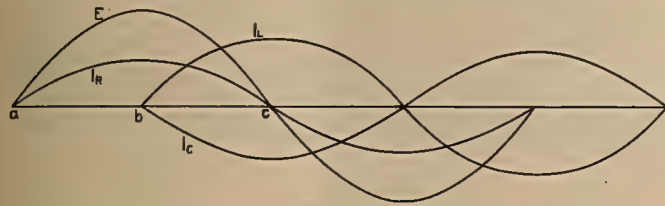


Fig. 4

Curves illustrating relation of pressure and flow in mechanical and electrical processes

mass M will now be forced back by the continued though declining pressure in A , and will again have reached its neutral position (moving in the opposite direction) at the instant when the pressure in A has decreased to zero and the pressure in B has started to increase (position c on curve), and the same half cycle is repeated in B as in A . It is now apparent that M alternates back and forth, but due to its inertia lags one-quarter period behind the force which causes its motion. It is also apparent that the flow of fluid in and out of the chambers A and B connecting pipes F and F is alternating in character, and maximum value (at b on the curve) Fig. 4. The mass will now be forced back by the continued though declining pressure in A , and will again have reached its neutral position (moving in the opposite direction) at the instant when the pressure in A has decreased to zero and the pressure in B has started to increase (position c on curve), and the same half-cycle is repeated in B as in A . It is now apparent that M alternates back and forth, but due to its inertia lags one-quarter period behind the force which causes its motion. It is also apparent that the flow of fluid in and out of the chambers A and B connecting pipes F and F is alternating in character, and since it coincides with the motion of M lags behind the pressure one-quarter period. Therefore a curve I_L (Fig. 4) drawn through b upward will represent the flow of fluid in the circuit L , and will lag one-quarter cycle behind E .

In Fig. 5, L_1 is an inductance made up of a number of turns of wire. When an alternating electromotive force is impressed on this coil, an alternating current flows. The flow of this current produces a flux, which, interlinking with the turns, induces a counter electromotive force in opposition to that impressed upon the circuit. This retarding effect causes the current to lag behind the electromotive force a quarter period. Therefore the curve of fluid flow in circuit L will also represent the curve of current flow in an inductive circuit such as L in Fig 5.

Again referring to Fig. 3, close all valves except the one controlling the flow of water through the long pipe R . In this circuit, there is no absorbing or

elastic medium to alternately absorb and discharge quantities of fluid; neither is there any moving mass of great inertia to retard the alternating flow of fluid. Therefore the flow of fluid through the pipe is controlled only by the frictional resistance, and the rate of flow at any instant is proportional to the difference of pressure between the two ends of the pipe. Consequently the rate of flow is a maximum when the pressure is a maximum, the rate of flow is zero when the pressure is zero. A curve of fluid flow can be represented by a curve I_R (Fig. 4) coinciding in time relation with the pressure curve E .

The resistance R_1 in Fig. 5 is non-inductive, containing no elastic or absorbing effect such as was

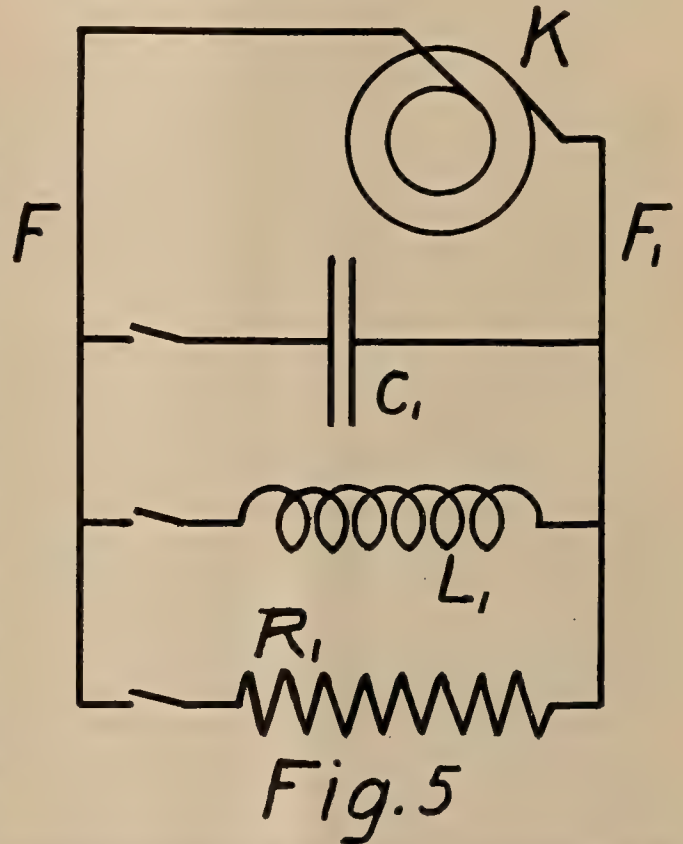


Diagram illustrating electrical parallels of principles demonstrated in Fig. 3

found in circuit C ; neither has it conditions which produce counter electromotive forces, or retarding forces such as was found in the inductive circuit L , hence the current at any instant is proportional to the electromotive force. The current will be a maximum when the electromotive force is a maximum and will be zero when the electromotive force is zero. Consequently the curve I_R , Fig. 4, will represent the flow of electricity in the resistance R_1 as well as the flow of fluid in the pipe R .

A WISE MAN

is considering the Northwest Electric Light and Power Association Convention —

Spokane, Washington, September 8-11



The above views of the recreation center which was established by the Southern California Edison Company for the men engaged in the construction of the Kern River plant, show what can be done in the way of providing wholesome entertainment to fill the leisure hours of the employees. The exterior of the recreation center is shown on the left and the moving picture show which took place in the mess hall is shown to the right.

A New Aspect of Public Utility Service

(Service to the public is the creed of the modern public utility, but service to the public means a spirit of cooperation and a high degree of efficiency within the organization itself. Two methods by which one large Western company works towards this are described below. Both authors are connected with the Southern California Edison Company.—The Editor.)

RECREATIONAL WORK IN CONSTRUCTION CAMPS

BY RICHARD E. SMITH

Realizing the importance of wholesome recreation for the men engaged in construction work at its new Kern River plant, the Southern California Edison Company has established entertainment headquarters under the direction of J. A. Mathews. This department was organized in November, 1919, and in the eight months period just closed 31,708 people have been entertained by the various programs offered. These have consisted of 187 moving picture shows, 11 dances, 14 ball games, and 4 boxing bouts, the schedule being so arranged that the workers in all the eight camps have an opportunity to attend.

There are two major recreation centers at which well equipped club rooms are maintained. In each of these buildings there are pool and billiard tables, card tables, a player piano and a phonograph, a barber shop, library and sales canteen at which candies, cigars and drinks may be secured at commissary prices. The libraries are supplied from the traveling library supported by Kern county, and have the distinction of being the best patronized of any of the branches, with a circulation each month of 135%.

Thursday of each week is ladies' day, giving the women living at the camps the use of the building for card parties in the afternoon, the evenings being devoted to dancing. From time to time "stunt nights" are given over to programs by local talent, and occasionally professional vaudeville players are engaged.

However, the principal entertainment features are the moving picture shows which are planned so that one is given every night at one of the camps. For these a seven reel program is arranged consisting of a five reel feature and a two reel comedy. These are the highest type of picture and are secured as soon as they are released from the large city playhouses. During warm weather these are given out of doors while the mess halls are used in the winter.

The pictures are rented for a week, and are circulated from camp to camp during that time.

Mr. Mathews has two assistants besides such volunteer help as may be needed on special occasions. All expenses are paid by the company except a table charge for billiards to cover maintenance of the equipment.

LUNCH SERVICE AT COST

BY GERTRUDE O. TUCKER

Service is the foundation of the modern public utility structure, and as charity begins at home, so the utility companies find that every privilege extended to their employees is reflected in the service which they give to the company and to the public.

Physical well being is so closely connected with mental efficiency that when one of the largest utility companies in the state announced that it would furnish to its employees a hot, home-cooked lunch at the cost of the food, the idea was welcomed as a big advance toward the ideal of efficiency.



Electric lunch room, Southern California Edison Company, Los Angeles

As electricity is the stock in trade of this utility, the natural thing was to turn its good offices to this most practical use. Two automatic ranges, with ovens that work on the fireless cooker principle, were installed. Electric cooking was an innovation to the woman in charge, but she took to it like a duck to water and was quick to make good use of all its conveniences. Even the manufacturers' agents were dubious about the behavior of the ranges under the high load factor of feeding more than one hundred a day, but now they are growing chesty over the record of nine months' continuous use without a serious interruption.

The kitchen is such an attractive part of the lunchroom that it is not separated from it, except by a screen and counter. The food is dispensed on the self-service plan, and this time-saving element is greatly appreciated by those who formerly stood in the long snake-like line at cafeterias, or waited for some slow-moving individual to bring them their lunch.

The self-service idea is also extended to drinkables. An electric urn furnishes coffee and hot water at the turn of the spigots, and the tea or

coffee is easily regulated to the strength preferred.

A steam table with electric elements keeps the food perfectly, even for the late comers, and leaves the cooking space and ovens of the ranges free for actual cooking. The elements beneath the steam table also act as warmers for the plates in the cupboards below.

But "the proof of the pudding is the eating," and the most encouraging remarks to those who sponsored this innovation are such as: "I have gained five pounds the last month and saved over five dollars on my lunches"; "I just can't eat at any other place in town—every time I do, I am sick"; and from one who earnestly watches that her weight does not go above a certain mark, "I simply must give up the lunchroom next month. I shall be a sight. Everything looks and tastes so good, it is no use trying to diet while I eat here."

Electric lights and flowers on the table help to make the picture an attractive one. Electric fans do their part in keeping the air fresh and cool, and the atmosphere of friendliness and contentment which originates in the electric lunchroom radiates to all other departments of the building.

Cost of Money

(The question of financing public utility improvements and extensions, rendered necessary by the phenomenal increase in demands for power, is inseparably bound up with the question of rate regulation. That the financial crippling of a power company for the benefit of its customers eventually reacts in inadequate service to those customers is brought out in the following article.—The Editor.)

It is generally recognized that the revenues of public utilities are at present insufficient to enable them to supply their territory with adequate service, and to enlarge their facilities in proportion to the continually increasing demands of the territory served, it being true that the revenues received for the service have been less than the necessary amount required to be expended to cover operating expenses, taxes and interest charges, and leave a sufficient reserve to offset accruing depreciation.

Public utilities must, in the immediate future, incur large expenditures for deferred maintenance and postponed construction of needed betterments and extensions. It is obvious that future revenues of the public utilities must be greater than past revenues (a) because extraordinary capital expenditures must be made, and (b) because current expenses due to increased wages, taxes and higher costs of labor, materials and supplies will be much larger than they have been in the past.

Unless regulating authorities adopt a policy that will enable public utility corporations to meet their increasing expenses and secure necessary capital for additions and betterments, the operation of these corporations will fail and the general public will be burdened with either an insolvent public utility or a public utility whose ability to serve is inadequate.

It is clear that if the general public is to be adequately served, the Commission must adopt a policy of regulation that will permit or cause the public utilities to obtain the income needed to establish such adequate service, afford a reasonable wage for em-

ployes, and such return on present investment as will induce investors to furnish additional investment to enable the public utility corporation to continue its construction program.

At present there seems to be no definite rule for rate regulation by public service commissions. There should be some effort to establish normal revenues, varied from time to time in accordance with the cost of money, and there should be some automatic or quickly available method for the varying of rates when necessitated by changed conditions.

The responsibility for maintenance of the credit of the corporation so that it can be continued on a sound economic basis rests definitely with the regulating authorities, and there should be a clear recognition on their part that adequate service is more important to the general public than a restriction of profits to a minimum.

The obligation to initiate reasonable rates and schedules as business exigencies require rests upon the management, and such management should not be interfered with by the regulating authorities except upon definite proof that the rates and charges, whether existing or proposed, are unduly burdensome. No complaint of the rates and charges of a public utility should have standing unless the complainant fully demonstrates the undue burden of his particular rate in relation to the circumstances of his use of the service.

The following rule might well be adopted in fixing rates and charges by governmental authority:

A rate may be charged that is designed to yield the utility in each class of service rendered, aggregate revenues which will provide (after adequate charge for recurring renewals and depreciations) such net return upon a fair value in the circumstances (determined by public authority) of the property devoted to the public use as will be sufficient in amount to enable the public utility to obtain, at reasonable cost, the capital required to furnish the public with adequate facilities and efficient and economical service.

Under such a rule rates ordinarily would be established that would permit the general public to make full use of the facilities provided. Further, a continually increasing demand for additional facilities would practically demonstrate that the existing rates were reasonable.

The public utility management will from time to time enter the money market and bid for new money for new facilities at as low a rate as possible, and the cost of this money to the company having good general credit should be construed as reasonable cost of money.

There is no normal price for securities of any particular kind, the general rule being—the greater the security and the greater the probability of payment when due and the greater the probability of a dependable return, the higher the price of the security and the lower the cost of money.

ELECTRIC COOKING SCHOOL

(Among the interesting events in which the electrical home has been featured recently is the six-days' electrical cooking school in Salt Lake City, described in the following article.—The Editor.)

A cooking school, served entirely with electricity, and featuring practically all the modern uses of electricity in the home, was conducted in Salt Lake City from August 2nd to 7th inclusive by the Salt Lake Telegram, in conjunction with the Utah Power & Light Company, all the other leading electrical concerns of the city, and various merchants and manufacturers of food products.

Miss Edith Clift, of Chicago, a domestic science expert, conducted all of the cooking demonstrations, which were given from 2 to 3:30 p.m. every day, preceded by a musical program from 1:30 to 2 p.m.

Miss Clift gave demonstrations in the preparation of practically every kind of food. She took up every branch of the culinary art, and showed the use of all kinds of materials and cooking appliances.

Entirely different demonstrations were presented each afternoon, and the course concluded with a special bread, pie and cake baking contest, in which hundreds of dollars' worth of prizes were distributed.

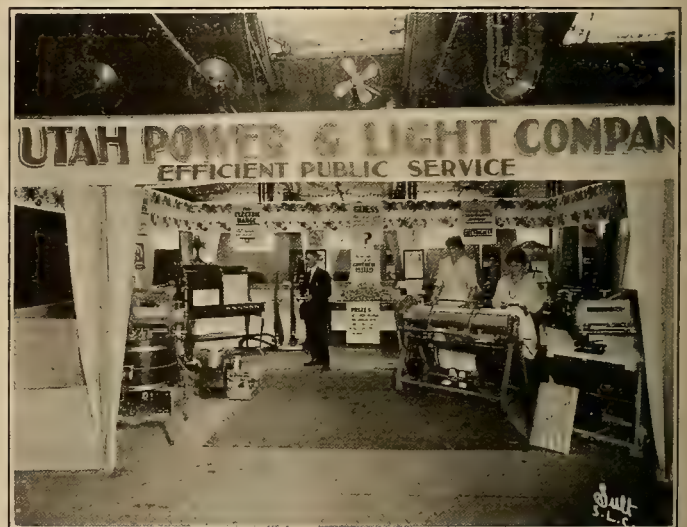
An amazing array of electrical appliances, some of which had never been shown before in the city, were on exhibition, to demonstrate to the housewives the modern way of avoiding household drudgery.

Cooking contests were held each day, for which valuable prizes were given, the prizes consisting of various electrical appliances contributed by electrical firms of the city, and various articles of merchandise contributed by the merchants and manufacturing firms. These daily contests, in which a large number of housewives participated, were in the making and baking of bread, various kinds of cake, doughnuts,

etc.; and a grand sweepstake prize of one electric range was given for the best individual loaf of bread.

Another contest which attracted considerable interest was one in which a large pile of two, three and four way attachment plugs was placed on a table, and the contestants were required to make guesses as to the total number of appliances which would be operated by these plugs.

One of the main features was a wedding which took place at the cooking school, the happy newlyweds receiving as a present an electric hope chest, which contained practically everything in the way of thoroughly up-to-the-minute work-destroying electrical appliances. Here is what was in it: Electric range, washing machine, vacuum cleaner, five table lamps, five cartons of Mazda lamps, vibrator, curling iron, toaster, iron, household motor, chafing dish, heater, milk warmer and warming pad. These were contributed by the following electrical firms: Utah Power & Light Company, Edison Electric Appliance



The above picture is of the six-day electrical cooking school which was conducted for one week during the past month in Salt Lake City. This was conducted under the auspices of the Salt Lake Telegram, the Utah Power and Light Company, the leading electrical concerns of the city and various merchants and manufacturers of food products. This sort of school gives much the same message to the housewife as does the more elaborate Electrical Home.

Company, Western Electric Company, Capital Electric Company, Intermountain Electric Company, and Kiser-Ackerman-Gardner Company.

There were hundreds of interesting and attractive exhibits, representing not only the electrical industry, but the products of the various manufacturers and merchants of the city.

Electricity was, of course, the feature, and the hundreds of housewives who attended the school were thoroughly convinced that the more extended use of electricity in the home would solve most of the housework problems with which they have been confronted—that the harnessing of electricity to the work of washing, cleaning, ironing, cooking, etc., would be the real solution.

The cooking school is an annual affair, and each one is better than the last. The one just closed was undoubtedly the best attended and most successful yet held, and more interest than ever was shown in the application of electricity as an efficient time and energy saver in the home.

The Industrial Load in California

(The industrial growth of California is one of the most significant developments affecting the electrical industry west of the Rockies. The fact that a great number of California's most important industries are large consumers of electric power is brought out in the returns from a survey carried out by staff of Electrical World for the McGraw-Hill Company, and published in full in Electrical World. Following is a digest of some of the data obtained.—The Editor.)

In an endeavor to ascertain the extent and distribution of the industrial load in California, detail questionnaires were sent to 1,289 industrial concerns.



A map of the state of California divided in four sections, showing the location of the leading industrial consumers of electricity in the state. Among the various industries that of food-preparation is the most important in value of products. This map was prepared as the result of a questionnaire sent to 1,289 industrial concerns for the purpose of ascertaining the extent and distribution of this industrial load in California. A comparison of this data with a similar survey which has been made of the entire United States shows that the central stations of this section of the country show an unusual mastery of the industrial situation.

The names of these firms were obtained through the various local chambers of commerce of the state, and the list is believed to represent the total number of primary industrial establishments employing more than fifty operatives each. The accompanying map shows the distribution of these industrial plants by sections of the state. Answers have been received from 229 companies which were so distributed among various industries as to give a very definite idea of the industrial power situation in California. Some very optimistic conclusions relative to the advantages of electrical energy in industry as a whole are to be drawn from this survey.

Principal Industries

The principal manufacturing industries in California using electricity as a source of power, as indicated by the survey, are iron and steel, including foundries and machine shops; shipbuilding; cement plants; food, including canning and preserving

plants; mining; paper mills and paper products; chemicals, and lumber and lumber products.

An interesting item brought out by the data obtained is the comparatively small amount of energy generated by private plants. The generation of energy by the private plants of lumber and mining companies is to be expected on account of their isolation and the difficulty in taking care of the waste, but the fact that with the further exception of the food and iron and steel industries, no report of other private generating plants was received is a clear indication of the efficient manner in which the central station is meeting the load requirements of California's industries. There is probably no other section of the country which can show such a mastery of the industrial situation by the central stations.

Food Preparation

The food-preparation industry is the most important in California in value of products. This industry includes the canning of fruits and vegetables, fish, oysters, clams, etc.; packing of dried fruits, the manufacture of pickles, jellies, preserves, sauces, etc.; wholesale slaughtering and meat packing and manufacture of sausage; flour-mill and grist-mill products; butter, cheese and condensed milk, and sugar manufacture. There are 316 plants of this general class in the state employing more than fifty operatives each, of which 45 per cent are in the north central part of the state.

The uses of electrical energy in factories of this industry are many on account of the varied processes necessary in the manufacture of food products. Motors are used to operate pumps, cream separators, churns, bottle and can washers, refrigeration machinery, conveyers, elevators, beet slicers, preserving machinery, presses, grinders, sealing machines, blowers and compressors. The heating of water and milk and the operation of cookers, sterilizers and dryers is accomplished in many cases by electrical energy.

Foundry and Machine Shops

The iron and steel industry, which in California is confined to foundry and machine shop activities, ranks fourth among the manufacturing industries of the state. There are about 208 plants of this class employing more than fifty operatives each, of which about 71.2 per cent are in the north central section of the state. This industry gives employment to about 7 per cent of the total labor of the state. In amount of electrical energy used, however, it ranks first among California's industries, and the returns indicate that about 31 per cent of the industrial load in the state is utilized by foundries and machine shops.

The uses of the motor in the iron and steel industry are not so varied as in the food-preparation

industry. Among the primary uses are the operation of cranes, air compressors, sand mills, planers, grinders, boring mills, straightening presses, fans, blowers, saws, drill presses, rolling mills, hoists, conveyors, sand-blast exhausters, etc.

Electricity in Shipyards

The shipbuilding industry could not be considered as a primary industry of California prior to the war. At the present time, however, it takes rank among the first. Practically all up-to-date shipbuilding yards are equipped throughout with the latest electrical devices. The thirteen shipbuilding plants reporting consume 41,116,484 kw-hr. of electrical energy per year. The survey indicates that no other class of industry in California consumes so much electrical energy per plant with the exception of cement mills.

Electric motors in shipyards are used to operate the following machinery: compressors, punches, shears, ship and overhead cranes, beading rolls, scarfers, angle benders, lathers, drill presses, pumps, boring bars, joiners, cutoff saws, shapers, pipe tools, winches, exhaust fans, bolt cutters, conveyors, marine railways, etc.

The adoption of electric drive in stone, clay and glass plants has been very general. One large cement mill reported an annual consumption of 20,866,970 kw-hr. This plant uses more than 158 motors with a total installed rating of 7,478 hp. About 87 per cent of the machines in this plant are belt-driven, and 12 per cent are direct-connected. Electric motors are used to operate crushers, rollers, kilns, elevators, conveyors, sack-filling machines, shovels, compressors, pumps, crane, screens, drills, etc.

Lumber Industry

Lumbering and lumber manufactures constitute one of California's primary industries. The manufacturing end of the lumber industry is almost all electrically driven at the present time. The logging operations which could be worked electrically to great advantage are handicapped in California, or in fact in any lumber country, by the scarcity of power transmission lines. Electric motor drives in wood-working plants have the advantage of decreasing the fire hazard, which is a big item in the lumber industry. Motors allow individual control and variable speed for machines such as hoists, veneer peelers and conveyors. One of the latest developments in the use of the electric motor in the lumber industry is to be found in electrically operated set works on carriages in sawmills.

Some of the machines operated by electric motors in the lumber industry are saws, lathes, shapers, borers, elevators, jointers, blowers, drill presses, pipe cutters, punch presses, pumps, sorting lumber tables, cranes, etc. The storage-battery locomotive for trucking is widely used in the lumber industry.

The adoption of electric drive in other California industries has not been as general as in those cited above. It is possible, however, that a fuller response to the questionnaires would show that several other industries were adopting electrical drive quite generally.

PROBLEMS IN ORNAMENTAL STREET LIGHTING

(The appearance of our cities during at least eight hours of the day depends largely upon the good taste and effectiveness of their street lighting. The value of an ornamental lighting system and the practical means of maintaining and installing such are discussed here by L. A. S. Wood, manager of the illuminating Section of the Westinghouse Electric & Manufacturing Company.—The Editor.)

The term "Whiteway" has been used extensively in connection with ornamental street lighting and has been the cause of considerable misapprehension on the part of the public as to the purpose of ornamental street lighting. An ornamental street lighting system should be considered as part of a scheme for beautifying the city as a whole and not as a means of advertising one section of a city perhaps to the detriment of some other locality.

The cost of the installation of an ornamental street lighting system might very well be borne by the property owners on the street where the ornamental system is to be installed, but the maintenance of such a system should be borne by the city as a whole.

The most satisfactory way of financing an ornamental street lighting system is for an improvement district to be created and the adjacent property owners assessed on a front foot basis in the same way as they would be assessed for any other municipal improvement. In general the expense to the property owner for the complete installation under a scheme of this character is very low, usually not more than \$1.50 per front foot, while the cost to the individual citizen for maintenance of the improved system from which he receives material benefit is negligible.

It is thought that the central station should discourage the indiscriminate installation of ornamental posts outside business premises and all suggestions for "Whiteways" should be the subject of careful consideration and consultation with the city authorities before the central station takes an active part in their promotion. Whiteways should always be considered in connection with the "City Beautiful" idea and in the light of ornamental systems benefiting the city as a whole rather than as a means of advertising some particular locality.

The manufacturers of ornamental street lighting devices may with advantage be consulted and their suggestions given very serious consideration before any ornamental system is designed, for some of the manufacturers of this class of apparatus have collected valuable data on the subject which is at the service of any city interested in the proposition.

There is considerable difference of opinion among engineers as to the best type of glassware for street lighting units, but the general consensus of opinion is in favor of diffusing glassware for ornamental units owing to the practical elimination of glare with this type of glass.

Glare within the range of vision of the pedestrian or vehicle driver should always be avoided. It causes the pupil of the eye to contract in an effort to protect the delicate mechanism of the retina, thus

preventing the observer from seeing as well as he would be able to do with a light source of lower intensity but more perfect diffusion.

The many new developments which are coming about in the realm of street lighting assure us that the "City Beautiful" will soon be an accomplished fact in so far as the lighting of our streets is concerned.

FUEL CONSERVATION AND WATER POWER

"It has become clearly recognized that cheap power is one of the basic factors enabling manufacturing countries successfully to compete in the world's markets," says Mr. Arthur V. White, consulting engineer with the Canadian Commission of Conservation, in a recently published reprint from the Commission's tenth annual report. The writer goes on to discuss the problem of fuel conservation, and the efforts which are being made to solve it in various countries:

"In the United States there were found in factories, office buildings, hotels, apartments, institutions, hospitals, etc., about 30,000 local electric generating plants. Many were readily supplied from some adjacent large central station. Where changes were made a general fuel saving of from 20 to 60 per cent resulted.

"The efficiency of a modern steam turbine approaches 80 per cent, although the terminal efficiency—that is to say the ratio of the heat unit equivalent to one kilowatt-hour at the generator terminals divided by the heat units in the fuel consumed to produce one kilowatt-hour—is, in actual practice, rarely higher than 20 per cent. Research is devoting special effort to improvement in this field, and some look to the vaporization of a combination of fluids instead of simply water.

"Effort is being made to standardize, within reasonably flexible limits, such apparatus or portions of apparatus as do not require to possess such variations as have hitherto existed. Take, for example, the standardizing of frequency for electric systems. We may expect, profiting from the lessons of the past, where new lines of industrial activity are opened up, there will be an increased effort to conform to certain basic standards, thereby avoiding complexity and inefficiency.

"In the United Kingdom the methods of mining and using coal have been the subject of an important and comprehensive investigation by the Coal Conservation Committee of the Ministry of Reconstruction. Its final report was issued in 1918. The present coal consumption, for power purposes, in the United Kingdom is at least 80,000,000 tons. By proper coordinated and centralized systems of power production and distribution for the whole country, it is estimated that 55,000,000 tons of coal per annum might be saved.

"The Reconstruction Committee lays special emphasis upon the part which power will play in the cost of manufacture and in the matter of international industrial competition, to which all countries are devoting such great attention. The economies resulting from the supplying of power to industry through the agency of the electric motor are everywhere recognized. In the munition factories erected during the war 95 per cent of the machinery was electrically driven.

"Respecting the question of conservation through the elimination of a great deal of the coal distribution by construction of power plants in the coal districts, the electric energy being transmitted to the various industrial centers of the country over high tension transmission lines, L. H. Rittenhouse, chief of the Power Section, Production Bureau of the U. S. Fuel Administration, says:

"It will only be a question of time before large super-stations will be constructed in some of the coal fields, particularly those near the congested industrial sections in the east, and full advantage taken of the opportunity to burn culm or refuse fuel, together with the advantage of distribution at high voltage to industrial centers."

"The near future promises increasingly great development of hydroelectric power for use in the electrification of railways now using steam motive power.

"Greatly increased attention is being given to the subject of the inter-connection of various electric plants, whether steam-electric or hydro-electric, or combination of both, with

the object of securing greater efficiency in the supply of power and light to districts respectively served.

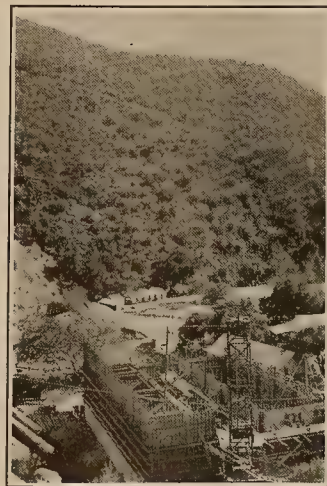
"Mr. L. R. Clapp, chief of the States Conservation Bureau of the Federal Administration, writes:

"The inter-connection of power systems, both steam and hydro-electric, offers an opportunity for real fuel economy. In many parts of the country duplicate transmission systems exist, serving practically the same territory. One or more of such lines may derive all or nearly all of its power from water while other companies use coal. No company operates with a continuous one hundred per cent load factor, and almost always the peaks are different for different companies. Therefore inter-connections permit the use of the maximum water power and also allow an increase in the average load factor."

"If authorities find through the enforced utilization of insulation upon steam piping, heaters, etc., or by the shutting down of uneconomical plants, or the substitution of efficient for inefficient apparatus, or the repair of apparatus, or in other ways, that very substantial savings of coal may be effected, then such economies, according to some reasonable scheme of administration, should be made compulsory in Canada."

SAN FRANCISQUITO PLANT NUMBER TWO IS PUT INTO OPERATION

The first unit in the Number Two plant belonging to the city of Los Angeles has been put into operation. The new plant, which utilizes water power from the Los Angeles aqueduct, is located in the San Francisquito Canyon some forty miles from Los Angeles and seven miles below Power Number One, which was put into operation in March, 1917.



A view of the San Francisquito Plant Number Two taken during the early days of construction.

The building structure is of reinforced concrete and of ample size to accommodate, when finally equipped, three 17,500-kva. G. E. three-phase, 50 cycle, 428 revolutions per minute generators. The generators are direct connected on the same vertical shaft to 25,000-hp. Francis turbines using 300 second-feet of water. General Electric exciters are used and are direct connected to the generators on an extension of the generator shaft. Spring thrust bearings of the same make are used between the exciters and the generators.

At present there are two seven-foot steel penstocks, 1430 feet in length, running from the forebay to the turbines. The plant has an operating head of 530 feet. When the plant is finally completed there will be three penstocks, the third one to be similar to the two already constructed.

The generator voltage is 6600 and is stepped up through a bank of three General Electric 5833-kva. transformers to 110,000. Each transformer is equipped with an oil conservator. Two banks of transformers have been installed, the second one having been put in operation since the recent completion of the installation of the second generator. No definite time has been set for the installation of the third unit. When the plant is finally equipped it will have a combined capacity of 61,500 hp.

Balance Sheet of

December 31, 1919

	ARIZONA		CALIFORNIA					
	Arizona Power Co.	Pacific Gas and Electric Co.	California-Oregon Power Co.	Great Western Power Co.	Pacific Gas and Electric Co.	Southern California Edison Co.	San Diego Consolidated Gas & Electric Co.	San Joaquin Light and Power Corp.
ASSETS								
Total Fixed Capital.....	\$ 6,585,449.35	\$ 2,739,486.65	\$17,467,792.55	\$58,650,813.89	\$151,030,720.87	\$ 74,749,309.13	\$ 9,617,682.10	\$ 29,692,031.87
Cash and Deposits.....	21,731.25	94,749.08	8,533.94*	3,999,245.95	2,201,751.26	1,027,553.19	110,530.70	368,282.88
Notes Receivable.....		191.60		104,757.08	54,100.37	69,328.16	9,978.18	371,555.15
Accounts Receivable.....	73,342.25	127,062.69	151,159.06	1,114,356.17	3,844,026.54	4,775,584.53	184,584.77	1,155,300.45
Other Current Assets.....	31,679.17			11,785.18	57,201.24	16.68	31,437.39	
Investments.....		80,461.57	211,383.31	1,608,391.58	1,032,813.80	5,403,243.60	14,800.00	363,413.60
Working Assets.....		71,755.11	103,641.05	403,467.65	8,826,890.83	1,746,225.20	237,192.45	1,058,575.57
Treasury Securities.....	2.00	17,000.00	1,717,000.00	5,741,800.00	1,358,952.35		688,000.00	668,359.17
Prepaid Expenses.....	219.79	5,126.33	5,811.24	207,376.37	29,185.66	390,190.08	4,544.41	12,320.08
Unamortized Discounts on Securities and Expense.....	996,229.85	12,392.80	801,237.82†	1,829,166.40	9,337,224.68	2,998,990.46	698,264.66	2,010,544.59
Miscellaneous.....	820.00	25,903.38	1,172,539.25	2,255,155.15	2,586,057.16	9,291,148.36	176,140.43	4,942,825.54
TOTAL ASSETS.....	\$ 7,709,473.66	\$ 3,174,129.21	\$ 21,622,030.34	\$ 75,926,315.42	\$180,358,924.76	\$100,451,589.39	\$ 11,773,155.09	\$ 40,643,208.90
LIABILITIES								
Capital Stock.....	\$ 3,945,000.00	\$ 1,200,000.00	\$ 10,000,000.00	\$ 28,838,526.37	\$ 62,801,138.00	\$ 34,556,872.00	\$ 3,900,400.00	\$ 17,500,000.00
Installments on Stock Subscriptions.....					1,252,500.00	248,092.92		321,259.98†
Funded Debt.....	2,120,900.00	1,286,400.00	5,600,000.00	40,931,900.00	94,140,558.15	49,771,000.00	6,707,000.00	16,980,000.00
Notes Payable.....	137,526.32	30,000.00	16,752.95		240,283.31	5,449,262.15		1,080,714.81
Accounts Payable.....	104,493.43	113,712.94	675,450.52	617,892.22	2,549,074.29	1,654,754.28	165,200.99	1,425,001.46
Interest and Taxes Accrued.....	33,090.89	4,375.00	1,129,798.29	977,035.23	2,387,390.31	720,840.45	197,536.01	345,740.75
Miscellaneous.....	6,992.44	105,502.94	1,728,230.20	229,780.00	549,503.65	1,153,197.55	41,169.50	83,295.34
Reserves.....	1,058,514.99	279,711.52	752,523.28	879,992.39	11,648,060.32	6,317,009.66	710,982.18	2,038,266.08
Corporate Surplus.....	302,955.59	154,426.81	1,708,487.10	3,451,189.21	4,790,416.73	580,560.38	50,866.41	868,930.48
TOTAL LIABILITIES.....	\$ 7,709,473.66	\$ 3,174,129.21	\$ 21,622,030.34	\$ 75,926,315.42	\$180,358,924.76	\$100,451,589.39	\$ 11,773,155.09	\$ 40,643,208.90
INCOME AND PROFIT AND LOSS ACCOUNT								
Operating Revenue.....			\$ 724,418.88	\$ 3,128,928.50	\$ 25,938,371.99	\$ 9,241,245.96	\$ 2,274,962.62	\$ 3,211,570.44
Operating Expense.....			452,156.20	1,570,443.63	17,578,262.39	5,445,341.45	1,638,046.33	2,215,982.47
Net Operating Revenue.....			272,262.68	1,558,484.87	8,360,109.60	3,795,904.51	636,916.29	995,587.97
Non-operating Revenue.....			1,660.42	191,763.70	583,849.69	1,461,761.68		52,269.21
Gross Corporate Income.....			273,923.10	1,750,248.57	8,943,959.29	5,257,666.19	636,916.29	1,047,857.18
DEDUCTIONS								
Non-operating Revenue Deductions.....				\$ 17,142.02	\$ 21,764.76	\$ 133,442.89		\$ 252.90
Interest Accrued on Funded Debt.....			\$ 284,800.00	1,115,221.27	4,279,743.52	2,727,131.10	\$ 314,880.00	675,302.40
Other Interest Deductions.....			23,942.86	13,588.80	5,513.42	13,789.97*	+5,328.41	64,287.96
Rent Deductions.....				156,887.06	1,365.91*	29,433.73	44,902.69	
Miscellaneous Deductions.....			6,018.79	76,864.11	297,950.67	398,265.74		34,121.22
TOTAL DEDUCTIONS.....			\$ 314,761.65	\$ 1,379,703.26	\$ 4,603,606.46	\$ 3,274,483.49	\$ 354,454.28	\$ 773,964.48
Net Corporate Income for Year.....			\$ —40,838.55	\$ 370,545.31	\$ 4,340,352.83	\$ 1,983,182.70	\$ 282,462.01	\$ 273,892.70
Dividends.....				386,222.13	3,237,056.06	1,950,883.39	277,260.98	390,000.00
Miscellaneous Additions to Income.....			6,449.19	3,501,265.16	94,954.29	2,563.58		2,503.68
Miscellaneous Deductions from Income.....			7,720.76	55,490.12	1,068,141.82	22,785.20	5,201.03	187,265.06
Surplus on Dec. 31, 1918.....			—759,127.70	21,090.99	4,660,307.49	568,482.69	50,866.41	1,169,799.16
Surplus on Dec. 31, 1919.....			—801,237.82	3,451,189.21	4,790,416.73	580,560.38	50,866.41	868,930.48

*Credit item.
†Corporate deficit.

†Capital surplus appreciation of fixed capital.

THE balance sheets presented here of the principal power companies of seven Western states should be studied by every reader of the Journal of Electricity. Study especially the balance sheet of your local power company and if it looks particularly healthy to you, show your good business judgment by investing in the securities of that company, as at the present time the average security of a central station will pay more than double the interest that you receive from your bank. If the power company

in your district is not making a fair return on the investment, make it your business to talk with the members of that company and find out exactly why it is not in a healthy financial condition. Then sell the idea to the community that the development of their community depends upon the ability of their local power company to expand; to have plenty of power to attract industrial enterprises and render excellent service to its consumers. This is only possible when the power company is allowed to charge

Western Power Companies

December 31, 1919

	IDAHO	MONTANA	NEVADA	OREGON		UTAH
	Idaho Power Co.	Montana Power Co.	Truckee River General Electric Co.	Pacific Power and Light Co.	Portland Railway Light and Power Co.	Utah Power and Light Co.
ASSETS						
Total Fixed Capital.....	\$ 24,619,305.22	\$ 92,519,483.71	\$ 10,592,453.74	\$ 17,698,300.08	\$ 58,708,771.88	\$ 58,399,503.69
Cash and Deposits.....	205,072.10	1,461,357.66	47,851.49	72,059.95	449,383.95	969,338.40
Notes Receivable.....	554,485.18	101,667.35	1,063.31	49,880.46	189,530.25	1,733,117.32
Accounts Receivable.....	405,996.71	752,435.40	31,665.37	440,352.54	452,090.58	678,516.28
Other Current Assets.....	13,229.20			5,551.98	39,553.98	192,896.55
Investments.....	178,855.00	529,297.20	15,750.00	1,018,727.66	7,571,372.46	12,576,784.51
Working Assets.....	265,126.18	544,137.63	18,754.50	342,992.48	502,750.21	575,040.97
Treasury Securities.....	789,400.00					
Prepaid Expenses.....	4,788.53	18,513.50	278.02	1,969.13	40,279.61	3,319.98
Unamortized Discounts on Securities and Expense.....	746,258.12	2,860,695.41		659,593.73	2,125,499.72	2,679,186.47
Miscellaneous.....	170,143.51	91,086.05		15,682.59	2,243,241.11 ³	21,711.00
TOTAL ASSETS.....	\$ 27,952,659.75	\$ 98,878,673.91	\$ 10,707,816.43	\$ 20,305,090.60	\$ 72,322,474.75	\$ 77,829,415.17
LIABILITIES						
Capital Stock.....	\$ 16,250,000.00	\$ 59,079,300.00	\$ 3,000,000.00	\$ 10,350,000.00	\$ 21,250,000.00	\$ 43,387,000.00
Installments on Stock Subscriptions.....					515,277.99 ¹	909.98
Funded Debt.....	9,999,789.88	32,942,700.00		9,119,000.00	42,496,000.00	23,566,000.00
Notes Payable.....	60,000.00		7,087,680.65	30,000.00	3,380,885.00	7,544,513.34
Accounts Payable.....	87,768.13	731,152.58	22,775.12	124,986.38	636,989.17	349,794.69
Interest and Taxes Accrued.....	287,323.55	938,582.40	8,615.86	334,252.78	928,898.86	677,240.32
Miscellaneous.....	61,533.21		22,585.17	62,549.96	161,626.26	579,167.95
Reserves.....	840,055.59	1,808,657.01	78,831.24	14,942.19	2,288,284.81	1,050,572.06
Corporate Surplus.....	366,189.39	3,378,281.92	487,328.39	269,359.29	664,511.66	674,216.83
TOTAL LIABILITIES.....	\$ 27,952,659.75	\$ 98,878,673.91	\$ 10,707,816.43	\$ 20,305,090.60	\$ 72,322,474.75	\$ 77,829,415.17
INCOME AND PROFIT AND LOSS ACCOUNT						
Operating Revenue.....	\$ 1,734,316.13	\$ 6,682,201.32	\$ 257,399.30	\$ 2,057,601.65	\$ 8,359,229.07	\$ 4,898,707.71
Operating Expense.....	1,058,895.11	2,477,874.30	124,998.09	897,823.36	4,905,080.47	2,787,338.42
Net Operating Revenue.....	675,421.02	4,204,327.02	132,401.21	1,159,778.29	3,454,148.60	2,111,369.29
Non-operating Revenue.....	147,042.60	169,780.26	4,509.49	36,696.41	219,274.89 ²	546,256.70
Gross Corporate Income.....	822,463.62	4,374,107.28	136,910.70	1,196,474.70	3,673,423.49	2,657,625.99
DEDUCTIONS						
Non-operating Revenue Deductions.....					\$ 61,364.83	
Interest Accrued on Funded Debt.....	\$ 261,354.17	1,656,843.53		\$ 443,773.45	1,913,948.68	\$ 1,178,300.00
Other Interest Deductions.....	162,116.83	148,833.56	\$ 87,556.16	19,038.92	88,338.52	351,838.68
Rent Deductions.....					80,974.55 ²	
Miscellaneous Deductions.....	37,764.94	428,575.30		206,263.97	652,144.23	133,114.13
TOTAL DEDUCTIONS.....	\$ 461,235.94	\$ 2,234,252.39	\$ 87,556.16	\$ 669,076.34	\$ 2,796,770.81	\$ 1,668,252.81
Net Corporate Income for Year.....	\$ 361,227.68	\$ 2,139,854.89	\$ 49,354.54	\$ 527,398.36	\$ 876,652.68	\$ 989,373.18
Dividends.....	211,815.99	2,350,826.00	45,000.00	355,544.45		921,045.73
Miscellaneous Additions to Income.....				18,182.20	132,794.54	
Miscellaneous Deductions from Income.....			20,000.00 ¹	26,500.00	898,656.82	
Surplus on Dec. 31, 1918.....	216,777.70	3,589,253.03	500,787.04	178,816.34	553,721.26	605,889.88
Surplus on Dec. 31, 1919.....	366,189.39	3,378,281.92	487,328.39	242,352.45	664,511.66	674,216.83

¹Bond discount. ¹Replacement Reserve.¹Street Improv. Bonds.
²Amortization of debt discount and expense.
³Includes Sinking Fund Assets.

enough for its service so that it can build up a reserve and surplus which will take care of its replacements and extensions as the territory which it serves expands and makes new demands upon it.

By all means get acquainted with the rates of the power company which serves you; get acquainted with their plans for expansion, their troubles in this day of rising prices and scarcity of labor, and become a booster for that company. Every time you hear

anyone "grouse" at the "light company" take it as a personal affront and defend them as you would yourself. For on the stability of the central stations the entire electrical industry is founded and unless they are able to earn a living wage and have the confidence of the people the entire industry will suffer.

Remember that the interests of your local central station are your interests, and back them up mentally, morally and financially.

Back Up Your Local Power Company Financially

What the Central Station Men Think of the Plan of Distributing Stock Among the Other Branches of the Industry

A. Emory Wishon, assistant general manager of the San Joaquin Light & Power Corporation, and who is responsible



for the "self-interest story" used in selling central station securities to consumers, has the following to say regarding the results obtained from the widespread sale of stock to consumers: "The work we have done has netted us results in the way of a more kindly public attitude to a greater degree than we had ever anticipated was possible, and each day the public is understanding better what the utility means to the com-

munity and what must be done in the way of allowing a fair return and protection to the utility in order that the utility may serve the community's best interests."

A. N. Kemp, vice-president of the Southern California Edison Company, in charge of security sales, one of the

ablest comptrollers in the West, states that the sale of bonds has always been handled by the banks without any difficulty. However, "the thing that would really benefit us would be to have common stock purchased by our friends, as we figure on providing from one-quarter to one-third of our requirements through this means. We have in vogue now a plan for selling stock on monthly instalments of five dollars a share



so that the machinery is already set up for such a plan as you have in mind."

A. F. Hockenbeamer, second vice-president of the Pacific Gas and Electric Company, who was responsible for the first

widespread sale of central station securities to the consumers of that company, and one of the foremost financiers on the Pacific Coast, said: "The distribution of public utility securities, whether they be bonds or stocks, among the jobbers, manufacturers and contractor-dealers will undoubtedly help the industry, and we are very glad indeed to see the Journal of Electricity using its influence in the furtherance of this



movement. We are firm believers in the value of a widespread distribution of our securities among the people living in our territory, as evidenced by the fact that we were the first public utility in the United States to put this theory into actual practice."

John A. Britton, vice-president and general manager of the Pacific Gas & Electric Company, whose opinion on mat-



ters of policy and public relations is widely sought, said in regard to the wider distribution of bonds among members of the electrical industry: "Incidentally I may say that I believe that your conclusions are correct—that the time is coming when bonds to be attractive must take on very much the same character as stocks. It does seem to me that if our holdings, either stocks or bonds, were to be subscribed for liberally

by the electrical fraternity, it would be a direct commendation to the company from a source that would be of great value. I will look forward with a great deal of pleasure to some interest being exhibited in our affairs by such a large and powerful organization as the manufacturers, jobbers and the contractor-dealers."

Franklin T. Griffith, president of the Portland Railway Light & Power Company and chairman of the Water Power



Development Committee of the National Electric Light Association, who has a thorough knowledge of the needs of the West and the possibilities for its development, said: "I am heartily in favor of wide distribution of our securities and it certainly would be a strong recommendation to the small investor if the members of the electrical industry generally could be referred to as holders of the securities of such companies.

In the sale of such securities to members of the industry the self-interest appeal should be made and should secure results."

F. M. Kerr, vice-president and general manager of the Montana Power Company, who is recognized as an authority on the supplying of power to electrified railroads by central stations, and who was chairman of the Committee on Railway Electrification at the recent N. E. L. A. convention at Pasadena, is heartily back of the plan to sell stocks of the power companies to members of the electrical industry. Mr. Kerr in speaking of the plan that has been suggested by the Electric Supply Jobbers' Association and adopted by the Journal of Electricity to secure a widespread sale of central station securities among men of the electrical industry, said: "I think the policy of getting local investors into the local power companies is a very good idea and one that should be very beneficial. I think that the power companies could really afford to pay more for their money than they would otherwise pay, in order to secure the local support."

SPARKS—Current Facts, Figures and Fancy

(After reading this page you will agree with us that letters and cows may soon be a convenience of the past and you will also know why we have the right to assert that horses are already passing into the realm of ancient history. Items on this page also tell how it takes a forest to produce a popular novel but only some properly applied air to double the production of electric steel.—The Editor.)

It is estimated that the oil wells of Mexico which are now under exploitation are capable of producing 1,000,000 barrels of petroleum per day.

* * *

The final farewell to the horse is coming not slow but sure. Already Denver has stated that after January, 1925, the faithful horse will no longer be allowed upon her streets.

* * *

It seems that forests must be sacrificed that literature may progress. No fewer than 500 trees must be cut down and worked up into paper for a novel that sells up to a quarter of a million copies.

* * *

Britain has launched her first electrically welded vessel. The ship is a 500-ton coaster, and in the construction of the hull, riveting has been entirely dispensed with, electric welding on the "quasi-arc" method taking its place.

* * *

It can truthfully be said, "The more asphalt pavement the better the city." And for this reason Buffalo has the right to hold her head very high, for she can claim the honor of having more asphalt pavement than any other city in the world.

* * *

Gasoline or no gasoline, the manufacture of motor vehicles goes on. Only 1,891,929 of these creatures were manufactured in this country last year while the estimated output for 1920 is 2,225,000 passenger vehicles and 425,000 motor trucks.

* * *

"Safety First" is by no means a slogan of the past, as will be seen by a glance at statistics showing that industrial accidents in a Western state last year caused the loss of 740,000 days' work, or the equivalent of the work of 1000 men for two and a half years.

* * *

A time saving of 25 to 50% in the production of electric steel has been accomplished by a recently developed method of blowing air into the solid charge of steel in the furnace. This corresponds to a reduction in energy consumption of between 150 and 250 kw-hrs.

* * *

In 1919 the world's gold production was over forty million dollars less than that of 1918. The figure for 1918 is \$380,924,500 while that for 1919 is between \$345,000,000 and \$350,000,000. Information received during the first six months of 1920

indicates a still further decrease this year. The probable output of the United States is less than \$5,000,000.

* * *

It seems that some men can be shocked and others can not. The story is being told of a certain Spaniard who enjoyed receiving a charge far higher than 7000 volts used in an American prison for the purpose of electrocution. He was also pleased to stand on a stage between two electrodes, and permitted a constant stream of lightning to pass through his body. And there are others. A man of Leicester is known to have handled parts of a dynamo that make the average man jump out of his boots.

* * *

It looks very much as though the peanut is to become a rival to the cow. Recent experiment has shown that our common, ordinary and popular little peanuts can be converted into four times their volume of milk, varying from four to eight per cent in fat content, and from 2.4 to 3.3 per cent in protein. This new product proves that it is truly milk in turning sour, curdling and allowing itself to be turned into cheese. The cost of production is said to be considerably less than the market price of dairy milk.

* * *

The latest in correspondence inventions carries with it a sad farewell to stenographers. This invention is the telegraphophone which combines the principles of telephone, telegraph and phonograph so that one talks into the machine and the message is recorded on disk records of thin steel which have been given the name of "talking post cards." These are sent through the mail and "played" on the telegraphophone of the recipient, who may erase the post card with a magnet and send it back with his return message.

* * *

It has been found that the generally useless seaweed is a nourishing and agreeable food for cattle. The plant is washed free of its salt and then treated with steam, preferably under high pressure, which causes the cells to burst and allows the protoplasm to come out. This mass is then placed under high pressure and formed into cakes, which are dried in a vacuum and ground into a coarse powder. The juice of the mass is boiled in a vacuum to a high grade of concentration, which causes the salts to crystallize, after which they are separated from the juice by means of a centrifugal separator. The juice is then mixed with the powder and the mixture pressed into cakes of suitable size.

PERSONALS

Wigginton E. Creed, president of the Pacific Gas & Electric Company, has recently succeeded Frank G. Drum in that position, the latter having retired after fifteen years due to the unusual demands of his other interests upon him. Mr. Creed is well known for his work in reorganizing the East Bay Water Company and also as president of the Hooper Lumber Company and as one of the founders of the Columbia Steel Company of Pittsburg, California. At the present time Mr. Creed is making a trip of inspection of the company's properties



with John A. Britton, vice-president and general manager, and P. M. Downing, vice-president in charge of electric operations.

J. C. Thompson, formerly secretary of the California-Oregon Power Company, has been appointed manager of the Klamath division of the company with headquarters at Klamath Falls, Oregon.

George J. Walton, manager of the Klamath division, California-Oregon Power Company, has resigned his position with that company to become cashier of the First National Bank of Merrill, Oregon.

W. M. Rosborough, assistant to the Pacific Coast manager of the National Lamp Works, Oakland, has resigned his position with that company. Mr. Rosborough is going East to accept a position as vice-president of a large jobbing house.

Major Ulysses S. Grant, 3rd, United States Engineer Corps, has been appointed to replace Col. William H. Kelly, in charge of the internal waterways in the third engineering district. Col. Kelly has gone to Washington to serve on the Water Power Committee recently created.

Byron H. Hurd, assistant secretary of the California-Oregon Power Company, has been appointed acting secretary of the company with headquarters in San Francisco. The California-Oregon Power Company have just moved from 129 Leidesdorff Street in San Francisco to new and more spacious quarters at 507 Montgomery Street.

K. E. Van Kuran, Los Angeles manager of the Westinghouse Electric & Manufacturing Company, has in charge the open day session of the Pacific Coast Electrical Supply Jobbers' Association, which will convene at Del Monte the latter part of November next. It is expected that the meeting will prove interesting and beneficial to an unusual degree, in that plans are already being laid for its consummation.

H. H. Bliss, State Supervisor of Trade and Industrial Education of the state of Nevada, and formerly in charge of Extension engineering courses for the University of California, has resigned his position with the state of Nevada and after September the fifteenth will be with the Riverside Junior College at Riverside, California. Mr. Bliss is the author of the series, Problem Course in Electricity, which is now running in the Journal of Electricity.

C. C. Hillis, vice-president and treasurer of the Electric Appliance Company, San Francisco, is largely responsible for the effort being made by the Electric Supply Jobbers' Association to sell central station securities to members of the electrical industry. His talk at the spring meeting of the association led to the questionnaires which were sent out by the Journal of Electricity which form the basis of the article

appearing in another part of this issue.

L. A. Somers, managing director of the San Francisco office of the Coast Equipment Company, has just returned from a 60-day trip to factories his company represents in Chicago, Pittsburgh, Ridgway, New York, Norwalk, Boston, Cleveland and Milwaukee. Mr. Somers reports all of these factories well supplied with orders, but great difficulty was experienced in securing coal, steel and cars in which to ship the manufactured product. In some cities there was a serious shortage of unskilled labor.

Capt. H. M. Gleeson, construction corps, United States Navy, who has been stationed at Mare Island Navy Yards for the past ten years, has sent in his resignation to the Secretary of the Navy to take effect at once. Capt. Gleeson has had immediate charge of the building of twenty-two vessels during the time that he has been stationed at Mare Island, including the battleship California. He is regarded as one of the most distinguished mechanical engineers of today in the field of shipbuilding and naval construction.

Clayton H. Sharp, technical director of the Electric Testing Laboratory, New York, and chairman of the Headlight Specification Committee of the Illuminating Engineering Society, is attending the International Traffic Officers' Convention at San Francisco. Dr. Sharp addressed the convention on the proper regulation of headlights and the Bay Cities Chapter of the Illuminating Engineering Society on accomplishments of the I. E. S. Dr. Sharp is one of the founders of this society and has always taken an active part in the work to make better lighting conditions.

S. M. Kennedy, vice-president of the Southern California Edison Company, Los Angeles, was present at the fall meeting of the Pacific Division of the Electric Supply Jobbers' Association, Del Monte, and highly endorsed the jobbers for the work that they have undertaken in helping the power companies finance themselves. Mr. Kennedy stated that the meeting of the jobbers which he attended was the most successful he had ever attended and that he was strongly behind their movement for securing a widespread distribution of central station securities among the members of the electrical industry.

R. H. Ballard, vice-president and general manager of the Southern California Edison Company and last year's president of the Pacific Coast Section of the National Electric Light Association, has been appointed chairman of the Public Relations Section of the Pacific Coast Division of that Association. Mr. Ballard has also been appointed one of the four gentlemen from that committee to be a member of the public policy committee, the other three being John F. Gilchrist, Commonwealth Edison Company, Chicago, M. S. Sloan, The Brooklyn Edison Company, Brooklyn, New York, and J. E. David, Nebraska Power Company, Omaha, Nebraska.

John B. Fiskien, consulting engineer, the Washington Water Power Company, Spokane, has just been appointed chairman of the Sections Committee of the American Institute of Electrical Engineers. Mr. Fiskien is also president of the Northwest Electric Light and Power Association convening in Spokane September 8th to 11th, and he deserves special credit for the work that has been done in the association during the past year. The executive ability of Mr. Fiskien has been demonstrated many times and this quality will assure the Sections Committee of the A. I. E. E. of an unusually successful year under his leadership.



Frank A. Leach, Jr., assistant general manager of the Pacific Gas and Electric Company, has been promoted to that position recently after twenty-two years of service with the company. Mr. Leach was formerly manager of Alameda district which is one of the largest in the company's territory, embracing as it does all of Alameda and Contra Costa counties. Mr. Leach has been very active in civic affairs and was one of the first presidents of the Oakland Chamber of Commerce and one of the directors of the First National



Bank of Oakland. His recent promotion is in recognition of the excellent manner in which he has managed the district for the past sixteen years and the esprit de corps which he has built up among the employes working with him.

J. F. Ryan, sales manager of the Western Electric Company at Portland, is spending his vacation in Alaska.

Emmet N. Britton, formerly associate editor of the Journal of Electricity, has been given the title of managing editor.

J. H. Graef, sales engineer with the Western Electric Company, has been transferred from the Seattle to the Portland office.

L. D. Morgan, lighting specialist, Western Electric Company, Seattle, attended the N. E. L. A. lamp convention held at Cleveland recently.

A. D. Williams, superintendent of motive power with the Southern Pacific Company at Sacramento, was a recent San Francisco visitor.

G. B. Kirker, manager railway department, Westinghouse Electric & Manufacturing Company, Los Angeles, was a recent visitor in San Francisco.

Alan W. Eshelby, Westinghouse Electric & Manufacturing Company, Seattle, Wash., has returned home after spending several days in San Francisco.

A. B. West, general manager, and E. B. Criddle, general agent, of the Southern Sierras Power Company with headquarters at Riverside, California, are recent San Francisco visitors.

H. B. Michner, stores manager of the Western Electric Company, Seattle offices, recently returned to Seattle from a trip to Chicago where he attended a conference of stores managers.

E. J. DesCamp, power apparatus specialist, Western Electric Company, identified with the Seattle offices, is back home after attending the power apparatus convention recently held in New York.

Francis C. Pratt, vice-president of the General Electric Company, with his family recently spent a few days in Portland. Mr. Pratt is making a tour of the Northwest on a combined business and vacation trip.

H. S. Jones, Robbins & Myers Company, San Francisco, has left for the East where he will spend some time at the company's factory at Springfield, Ohio, getting acquainted with their manufacturing methods.

Albert H. Elliot, secretary of the Pacific Division, Electric Supply Jobbers' Association, delivered an address at the recent convention of the National Traffic Officers on the subject of "Internationalization of Traffic Laws."

C. E. Magnusson, professor of electrical engineering and acting dean of the college of engineering at the University of Washington, has been appointed chairman of the Educational Committee of the American Institute of Electrical Engineers.

W. A. Louy, special representative of the Conlan Washer Machine Company of Chicago, recently completed a month's work in the Northwest in sales promotion effort. He reports being well satisfied with results attained.

F. G. Parker, formerly assistant superintendent of distribution of the Northwestern Electric Company, has been made secretary of the Portland Joint Pole Committee, to fill the vacancy created by the illness of Mr. James Curran.

D. G. Hayes has accepted the position of cashier at the local office of the Western Colorado Power Company. Mr. Hayes has been located at the Durango office of the same company and previous to coming to Colorado was with the Westinghouse Electric & Manufacturing Company for eight years.

James Scrugham, state engineer of Nevada, has been appointed water master for the Truckee river district by Judge Farrington of the federal court. The creation of this new office of water master assures the delivery to Fernley farmers of such water as may be obtained from Lake Tahoe by the Reclamation Service.

H. J. MacIntire, formerly professor of chemical engineering at the University of Idaho, has entered the Department of Mechanical Engineering at the University of Illinois at Urbana, Illinois. Professor MacIntire has been a recent visitor at San Francisco, Seattle and other Pacific Coast points preparatory to leaving for his eastern duties.

R. H. Ballard, vice-president and general manager of the Southern California Edison Company, A. C. Balch, vice-president of the San Joaquin Light & Power Corporation, and A. E. Wishon, assistant general manager of the San Joaquin Light & Power Corporation, were in San Francisco recently attending a conference with the State Railroad Commission.

J. M. Buswell, general agent for the San Joaquin Light & Power Corporation, was the author of the interesting article, "Making Ice Cream Electrically," which appeared unsigned in the last issue of the Journal of Electricity. Mr. Buswell's work brings him into close touch with the many industrial users of electricity in the San Joaquin valley, and another contribution by him on a similar subject will appear in an early issue.

Walter C. Heston, industrial engineer with the Portland Railway Light & Power Company, has recently become associated with the Journal of Electricity as Northwest correspondent in Portland, Ore.



Mr. Heston is secretary of the Portland section of the American Institute of Electrical Engineers, and has been very active in the affairs of the A. I. E. E. in the Northwest. He was in part responsible for the great success of the recent convention of the Institute at Portland, taking an energetic part in the arrangements for the

event. His affiliations keep him in particularly close contact with the engineering activities of the Northwest, and the Journal of Electricity is glad to be able still further to improve its service through this new connection.

OBITUARY

General William Marshall, Corps of Engineers, United States Army, died recently in Washington, D. C. General Marshall at the time of his retirement was Chief of Engineers and immediately afterwards became consulting engineer for the Secretary of the Interior. He was a lover of the great West and discovered the pass over the Rockies in Colorado which now bears his name.

Meeting Notices for Electrical Men

(The newly formed Rocky Mountain Division of the N. E. L. A. was actually put into operation at the first meeting of its Executive Committee which is reported in full below. A detailed account is also given of the regular quarterly meeting of the Pacific Division of the Electrical Supply Jobbers' Association. In view of the forthcoming Spokane convention, the account here given of the meetings of the committees of the Northwest Electric Light and Power Association is of especial significance.—The Editor.)

Rocky Mountain Division, N. E. L. A.

The Executive Committee of the Rocky Mountain Division of the National Electric Light Association held its first meeting at the Denver Athletic Club, Tuesday, August 3rd. There were present E. A. Phinney, president, A. C. Cornell, secretary-treasurer, C. D. McClure, Denver, Colorado, Arthur Prager, Albuquerque, New Mexico, and E. P. Bacon, Casper, Wyoming.

The constitution for this Division was adopted subject to the approval of the National Electric Light Association. A copy of the proof of this constitution will be forwarded to the Executive Manager within a few days.

The following appointments for divisional chairmen for the special sections were made:

Public Relations Section: Mr. Bulkeley Wells, president, Western Colorado Power Co., Denver, Colo.

Technical Section: Mr. T. O. Kennedy, general superintendent, The Denver Gas & Electric Light Co., Denver.

Commercial Section: Mr. C. N. Stannard, secretary and commercial manager, Denver Gas & Electric Light Company, Denver.

Accounting Section: Mr. Charles E. Twogood, Albuquerque Gas & Electric Co., Albuquerque, New Mexico.

The chairmen of the above committees are to appoint their own committeemen, one from each state represented in the Division.

It was decided to hold a joint convention of the Rocky Mountain Division, N. E. L. A., with the Colorado Electric Light, Power and Railway Association at the Hotel Colorado, Glenwood Springs, Colo., Monday, Tuesday and Wednesday, Sept. 13, 14 and 15. Matters of general interest are to be discussed at the joint convention, but each organization is to hold separate business sessions.

The president presented a letter from Mr. Martin J. Insull, president of the National Electric Light Association, practically assuring Mr. Insull's presence at the convention above mentioned. Elaborate plans are being made to make this convention a great success.

Mr. A. C. Cornell, secretary and treasurer of the Rocky Mountain Division, and Denver salesman of the Western Electric Company, entertained the executive committee at a luncheon at the Denver Athletic Club.

Mr. E. A. Phinney, president of the Rocky Mountain Division, entertained the members of the executive committee and a number of operating executives and representatives of manufacturers and jobbers at a dinner at the new Troutdale Hotel, in Bear Creek Canyon.

Jobbers Meet at Del Monte

The regular quarterly meeting of the Pacific Division of the Electrical Supply Jobbers' Association was held at Del

Monte in the early part of August. Due to the fact that it was vacation time and the meeting followed so close on the heels of the big convention that was held there in May, and the N. E. L. A. convention the same month, the attendance was very light.

The first two days of the meeting were devoted to the business of the association and on Saturday morning a general meeting was held at which three excellent papers were presented. The first paper was by W. M. Deming, on "What Is the Present Financial Outlook?" Mr. Deming's conclusions that the electrical industry was on a firm footing were drawn from the answers to questionnaires that had been sent

out to the leading manufacturers of electrical appliances, wire, motors, and to typical business and banking institutions throughout the United States.

The second paper, by A. M. Irwin, assistant to the treasurer, Westinghouse Electric & Manufacturing Company, dealt with the "Credit Situation" and put particular stress on conditions on the Pacific Coast. He stated that while the banks are calling in loans, there is plenty of money for anyone engaged in a business that supplies essentials. The only businesses that are finding it difficult to obtain extended credit are those engaged in the manufacture of luxuries.

Robert Sibley, editor of the Journal of Electricity, presented the third paper, which dealt with "The Financing of Central Station Securities." In delivering his paper Mr. Sibley quoted from letters which he has received

from presidents and general managers of the largest power companies in the West, stating that the plan for the sale of central station securities to the men of the electrical industry supplied by that central station is one of the greatest movements ever started, for while the material gain will be small the result will be far-reaching as it will show the public a united industry which has confidence in itself. This confidence is bound to be felt by the public who will see that the development of the West depends upon the development of its hydroelectric resources.

In the golf tournament the prizes won were as follows: Deming trophy—won by W. B. Sawyer, Jr., sales engineer, U. S. Steel Products Company, San Francisco; Turner trophy—tie between A. M. Irwin, assistant to the treasurer, Westinghouse Electric & Manufacturing Company, and W. M. Deming, Pacific Coast manager, McGraw-Hill Company; The Old Copper Cup was won by C. C. Hillis, vice-president and treasurer, Electric Appliance Company, while L. H. Newbert,

BUILDERS OF THE WEST — LXXXIV



WILLIAM G. KERCKHOFF

By the vision of those Western financiers who saw the possibilities in desert lands and mountain snows and who had the courage to build by this faith is Western accomplishment to be measured. To William G. Kerckhoff, sponsor of the newly opened Kerckhoff Power Project, president of the San Joaquin Light & Power Corporation, to whose keen visualization of the latent values of the San Joaquin Valley and the services which electricity might render in its up-building, much of the present development of this fertile region may be credited, this issue of the Journal of Electricity is affectionately dedicated.

manager of the commercial department, Pacific Gas & Electric Company, won the Central Station trophy.

The following members attended the meeting:

E. G. Alexander, Alexander & Lavenson, San Francisco.
 W. S. Berry, Western Electric Company, San Francisco.
 T. E. Bibbins, Pacific States Electric Company, San Francisco.
 J. O. Case, local sales manager, General Electric Company, Los Angeles.
 H. H. Daley and wife, Majestic Electric Development Co., San Francisco.
 R. J. Davis, local representative, Century Electric Motors Company, San Francisco.
 W. M. Deming and wife, McGraw-Hill Company, Inc.
 L. W. Davis, branch manager, Westinghouse Lamp Company, Los Angeles.
 A. H. Elliot, attorney-at-law, San Francisco.
 N. W. Graham, Graham-Reynolds Company, Los Angeles.
 Phil Gough, Listenwaller & Gough, Los Angeles.
 H. L. Garbutt, manager supply division, Westinghouse Electric & Manufacturing Company, San Francisco.
 C. M. Gifford, Westinghouse Lamp Company, San Francisco.
 C. B. Hall, Illinois Electric Company, Los Angeles.
 D. E. Harris, Pacific States Electric Company, San Francisco.
 C. C. Hillis, Electric Appliance Company, San Francisco.
 R. D. Holterman, manager Holabird Electric Company, San Francisco.
 A. M. Irwin, assistant treasurer, Westinghouse Electric & Manufacturing Company, San Francisco.
 R. F. Oakes, National Carbon Company, San Francisco.
 H. L. Randall, Capital Electric Company, Salt Lake City, Utah.
 H. E. Sanderson and wife, Bryant Electric Company, San Francisco.
 W. B. Sawyer, Jr., sales engineer, U. S. Steel Products Company, San Francisco.
 H. B. Squires, president and manager, H. B. Squires Company, San Francisco.
 Robert Sibley, editor, Journal of Electricity.
 S. H. Taylor, Electric and Manufacturers' Supply Company.
 H. W. Turner, Montana Electric Company, Butte, Mont.
 K. E. Van Kuran, district manager, Westinghouse Electric & Manufacturing Company, Los Angeles.
 C. E. Wiggin, manager electric department, Dunham, Carrigan & Hayden Company, San Francisco.
 W. C. Wurfel, Westinghouse Lamp Company, San Francisco.
 S. M. Kennedy, Southern California Edison Company.

Meeting of Northwest Electric Light and Power Association Committees

Special Committee —

A meeting was held on Wednesday, August 11, in Portland, of a special committee to report to the forthcoming annual convention in Spokane on revision of the constitution of the Northwest Association.

The principal object of the revision is to make the association year run concurrently with the N. E. L. A. year so that the representation on the N. E. L. A. committees from the Northwest Association committees may run concurrently as to terms and personnel. This will make the association year commence from July 1, and probably necessitate the annual convention being held during June instead of September.

The constitution follows as closely as possible the N. E. L. A. constitution, with certain exceptions to fit conditions peculiar to the Northwest.

Under the proposed revision the executive committee is to be constituted as at present, with the exception of the addition of the chairman of the executive committee of each of the sections, these sections being accounting, commercial, public relations and technical. The Hydroelectric and Technical Section has been designated as the Technical Section.

The election of officers at the annual convention will mean the election of an entirely new personnel.

Executive Committee Meeting —

The executive committee met on Thursday, August 12, the two questions of major importance being, first, acceptance by the committee of the report of the advisory committee of the governing committee of the commercial section, with reference to organization of the "Northwest Electrical Service League," to promote closer cooperation between the central stations, the contractor-dealer, the jobbers and the manufacturers, based largely upon the so-called "California Cooperative Plan." This report will be recommended for adoption by Class A members at the annual convention.

The second subject of importance was the report of the special committee on revisions to the constitution. The executive committee approved the report of this committee with certain modifications. It was proposed by the special committee that the executive officers should be chosen by a refer-

endum vote of Class A members; this proposal was not accepted, and the present method was indorsed.

Other matters of detail having to do with the annual convention and routine matters were considered.

Membership Committee —

On Friday, August 13, there was a meeting of the membership committee to formulate its report for the forthcoming convention, which will contain a report of progress and recommendations of ways and means of increasing membership.

San Francisco Electrical Retail Dealers Hear Sales Talk

The San Francisco members of the California State Association of Electrical Contractors and Dealers who are in the retail dealers' section met on the evening of August 4th. The speaker of the evening was M. Meyers, retail sales manager of Nathan Dohrmann Company, who spoke on "Some Phases of Retail Merchandising and the Business Outlook." Mr. Meyers took up the relation of each article of merchandise in the store to the entire stock, and the question of a fair margin of profit. Store organization and management, credits, methods of attracting business, including advertising, were some of the points touched by Mr. Meyers. By a series of actual figures he showed the necessity of paying special attention to small leaks, waste and breakage, and the effect that these had upon profit. There was a very enthusiastic discussion on several of the points brought out by Mr. Meyers, who took part in the discussion and willingly answered all the questions that were put to him.

A committee was appointed to arrange for another meeting in the near future, and to arrange for some other speaker to present a topic that would make for better merchandising methods. It is expected that all of the San Francisco members of the retail section of the state Contractor-Dealers' Association will attend the next meeting on account of the enthusiasm resulting from this meeting, which was held with the idea of making such meetings a regular institution provided enough interest was shown to make it worth while.

Meeting of the Utah Section, A. I. E. E.

A special meeting of the Utah Section of the A. I. E. E. at the Commercial Club, Salt Lake City, was held on August 16th. Mr. H. T. Plumb, General Electric Company, Salt Lake City, reported that at the Pacific Coast convention of the Institute a motion had been carried the sense of which was that the annual convention should meet conjointly with the Pacific Coast convention in 1921 in Salt Lake City. Mr. Plumb then offered the following motion: "That the secretary be instructed to write a letter to Mr. Hutchinson which can be submitted to the Board of Managers of the A. I. E. E. inviting them to hold the next annual convention in Salt Lake City in conjunction with the Pacific Coast convention." Mr. F. L. Hutchinson, secretary of the American Institute of Electrical Engineers, then spoke on the subject of "Institute Activities."

Advisory Committee, California Cooperative Campaign

At the last meeting of the Advisory Committee of the California Cooperative Campaign it was announced that besides the electrical homes established in San Francisco, Oakland and Sacramento, plans had been made for similar homes in Stockton, Fresno, Bakersfield, Los Angeles, Long Beach and San Diego. The newspapers of these cities cover in a satisfactory manner the entire state of California and appeal directly to the large centers of population. It is estimated that \$20,000 will be spent in advertising these homes, of which the subdividers will spend \$12,000 and the electrical interests \$8,000. It is estimated that more than 200,000 people will visit these homes. It is the purpose of the Advisory Committee to finish the electrical home campaign by December in order to secure the maximum effect on the Christmas shopping.

HAPPENINGS IN THE INDUSTRY

GREAT WESTERN POWER COMPANY BOND ISSUE

An order which has been issued by the Railroad Commission authorizes the Great Western Power Company of California to issue \$3,500,000 of 8% ten-year bonds. The proceeds will be used to defray the cost of completing the Caribou power development on the Feather River and the transmission line from the Caribou plant to Valona, Contra Costa county. It was originally estimated that the cost of the Caribou plant and the transmission line would total \$6,057,430. Today it is estimated that the total will reach \$10,674,897.66, an increase of \$4,617,467.66. According to the evidence submitted with the application the increase is due to enlarging the tunnels so as to permit of the construction of an 80,000 kilowatt plant instead of a 60,000 kilowatt plant as originally planned and to unforeseen difficulties experienced in tunnel construction. Increases in cost of materials and supplies, increases in wages and difficulty in keeping employes permanently engaged on the construction work are also given as reasons for the additional cost.

This latest addition of two units in the new Caribou plant, which will be put into operation early in 1921, will bring the total capacity of the system up to 139,500 kw. This means a growth in the past twelve years which trebles its earlier capacity.

This is but the first step in a plan of progress which will eventually bring the development along the Feather River to a total of 486,000 kw., or about 640,000 hp.

NEW FINANCING BY PACIFIC POWER & LIGHT COMPANY

The Pacific Power & Light Company, with main offices at Portland, Oregon, has made a new issue of 8%, 10 year bonds to mature in 1930, for \$1,000,000, which are secured by a mortgage on the company's property and business, subject to its present mortgage, and is also secured by deposit of a like amount of the company's bonds issued under the present mortgage.

The bonds were purchased by the N. W. Langley & Company bond house of New York, and are being handled locally by Blythe Witter & Co., Ladd & Tilton Bank, Freeman Smith & Camp, Lumberman's Trust Company and E. L. Devereaux & Company.

The price is \$98.25, to yield the investor 8¼%. Half a million dollars of the money is to be used to take care of the company's present floating indebtedness for improvements and the other half-million dollars is to pay for the new steam electric generating station at Astoria. It is understood that this money cost the company in the neighborhood of 10%.

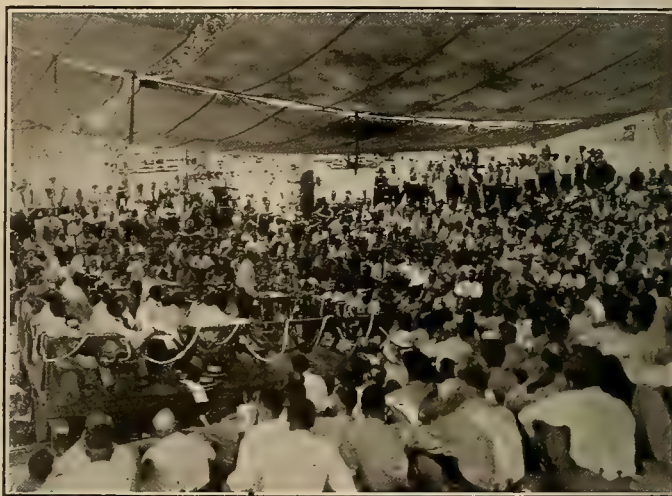
RATE INCREASE GRANTED COAST VALLEYS GAS AND ELECTRIC COMPANY

An increase of 15% in its charges for electric energy for power purposes has been allowed the Coast Valleys Gas and Electric Company by the Railroad Commission. The company's lighting rates are not changed. The new rate is to be collected on and after August 13 for a period of nine months, this being the time that the Coast Valleys Company will have to pay 15% more for the power it purchases in accordance with a recent decision by the Commission establishing an emergency rate to be collected by the Pacific Gas & Electric Company which sells to the Coast Valleys. The increase is in the nature of a surcharge. It is estimated that the new rate will result in an increase in revenue of approximately \$22,000 during the nine months.

KERCKHOFF POWER PROJECT IS COMPLETED

The Kerckhoff power plant of the San Joaquin Light & Power Corporation, which is situated on the San Joaquin River near Auberry, about thirty miles from Fresno, was opened on the fifteenth of August with ceremonies in which the electrical men of the state and the general public took part. The maximum output of the plant amounts to 50,000 horsepower. It was constructed at a cost of approximately \$5,500,000.

It is claimed that the erection of the project has been accomplished in record time, the entire project being com-



Colonel Harvey D. Loveland, of the Railroad Commission of California, addressing the gathering at the opening of Kerckhoff power house. Only a few of the 2,280 people in attendance could be caught by the camera. Colonel Loveland is telling his listeners that if they accept General Manager Wishon's invitation to become partners with him in the San Joaquin Light & Power Corporation, they will occupy the unique although advantageous position of being at the same time the boss of the Railroad Commission and likewise under its jurisdiction and subject to its regulation.

pleted and placed in operation in less than fifteen months from the time the first work was begun.

The construction work has included the erection of a dam 104 feet high in the San Joaquin River, the driving of a tunnel 17 by 17 feet through solid granite for a distance of about four miles, and the erection of a power house and conveyor pipes at the end of the tunnel line. In addition to being one of the largest projects in the state, it is the first to be started and completed since the war. A lake has been created 3½ miles in length, which will be kept continually full to provide the power.

More than 2000 persons attended the opening ceremonies at which time William G. Kerckhoff, president of the San Joaquin Light & Power Corporation, opened the switch putting the plant on the line. He was assisted by Rex Starr, Jr., son of Construction Engineer Starr.

Pamphlets descriptive of the project were dropped from the airplane fleet of the local forestry air patrol which later landed at Auberry, at which time the public was permitted to use the wireless telephones. Visitors were escorted and directed over the entire project by employes of the San Joaquin Light & Power Corporation.

The Fresno Republican commented upon the task which has been accomplished in an editorial appearing under the title, "Not By Luck," excerpts of which appear below:

When timely rains relieved the threatened spring water shortage, we attributed it according to our respective degrees of piety, to luck or

providence. Now that timely electricity relieves the late summer shortage, by starting thousands of pumping plants, many of us will give it not much more thought. * * *

The fact is that it was not luck or providence, but grit and desperate effort, that relieved the shortage. There was natural gas enough in Bakersfield fields, but no machinery to turn it into electricity. There was flowing water enough in the larger Sierra streams, the Kings and San Joaquin rivers, but there was no way to make it available. * * * So the officials and engineers of the San Joaquin Light & Power Corporation set themselves to accomplish the impossible. Out of a tightening money market, with no money to be had, they somehow raised the money. Out of a machinery market in which everything was over-ordered for more than a year ahead and quick delivery on nothing could be had, they somehow did get engines and dynamos and pipes, and the steam plants, burning natural gas and oil, are now working.

In the Sierra, the task was more impossible. Between the San Joaquin river and its effective use lay three miles and a half of solid granite mountain. Granite can be tunneled, but only at a certain speed, and at the highest speed ever known the tunnel could not be completed until long after the calamity would have happened. * * * Steam shovels were set to building roads, and pipes laid to water those roads and keep them passable. Preliminary machinery was dragged bodily over the mountain sides before the roads were ready. A great dam was built across the San Joaquin river while that river was running, between almost vertical walls of solid granite. Tunneling was started from several points at once, all so accurately surveyed that each section joined perfectly to every other, when they met. Twenty-four hours a day, month after month, without an instant's stop, men worked day and night, not at a walk, but at a racing run. New machinery and methods were invented, to make results swifter.

So the tunnel was finished a month ahead of even the rush schedule. A location was selected where the descending pipe lines and the outlet to the lower river could best be brought together. There was no place to build a power house, so one was blasted out of the solid granite, in the mountain. Then the whole San Joaquin river was turned through the tunnel, leaving eight miles of its bed dry; it was imprisoned in great steel pipes anchored to the mountain side; through concealed nozzles it dashes under almost explosive pressure against the blades of great horizontal Pelton wheels; these wheels turn great generators which send the released power of the river down tiny wires to the fields and factories of central California—and the river flows out of outlets below and continues its way as if nothing had happened, to the irrigated fields or to the sea.

For the future, everything is as simple as turning a switch and letting the river flow. But to make it simple and easy, and to deliver it quick, has been a desperately hard and complicated task.

NEW POWER RESTRICTIONS FOR CALIFORNIA

Following a conference with representatives of power companies at which was discussed at length the serious power situation in northern and central California, the acuteness of the situation and the need for drastic action was recognized by the utility representatives, all of whom gave it as their opinion that serious consequences would follow failure to meet the situation immediately. As a result of the conference H. G. Butler, power administrator of the California Railroad Commission, issued the following order, effective August 20, 1920:

"(1) The use of electric energy for power purposes, except for domestic use and use in connection with growing crops and handling of perishable foods, shall be reduced 20%.

"(2) The use of electric energy for the irrigation of vacant lands and of lands from which crops have already been harvested shall not be permitted during the present shortage.

"(3) The attention of consumers of power for the irrigation of growing crops shall be called to the fact that unless a large reduction is voluntarily made drastic restrictions will become necessary.

"(4) The power companies shall direct the attention of city officials in their territory to the fact that electric energy used in street, sign and display lighting is being lost for productive purposes, and shall urge them to restrict this use as far as may be consistent with public safety.

"(5) The above reductions in the use of electric energy shall be made, as far as possible, between the hours of 7 a.m. and 10 p.m.

"(6) The power companies shall insert in all papers published in the territory they serve an advertisement referring to this order, calling attention to the power shortage, and urging consumers to conserve electricity used for any purpose in every way possible."

The order will be sent to thirty power companies, large and small, operating in the northern and central part of Cali-

fornia, and a copy will be mailed to the five municipalities that sell electricity for the purpose of calling the attention of city officials to the grave situation caused by the power shortage.

At the conference, which was held in the rooms of the Railroad Commission August 19, the opinion was expressed that as the agriculturists of the state had already borne a share of the burden imposed by the power shortage they should not at this time be required to do other than to continue their cooperation by following the restrictions already in force, except in cases where vacant lands or lands on which crops had been matured were being irrigated.

It was practically agreed that it was necessary that the curtailment now ordered should fall on all industries, which includes street railways, the administration of the order being left to the power companies because of their familiarity with conditions in the various districts.

As a further means of curtailment the resale companies were directed to file with the Power Administrator all applications for new power above 2½ horsepower, the administrator to determine whether the power asked was for an essential industry. This practice has been followed by the generating companies for some time.

MANY SHOWS TO BE STAGED IN SEPTEMBER

Plans of the Western Electric Company are practically completed for shows to be staged during the month of September at the Eastern Washington Fair, Spokane; Washington State Fair, Yakima; Walla Walla County Fair at Walla Walla, and the Oregon State Fair at Salem. Also, local distributors or agents in the districts contiguous to the larger cities will stage demonstrations at approximately twenty smaller fairs during the fall months.

Low voltage power and light outfits, commonly called farm lighting plants, and household appliances for farm use will be exhibited and demonstrated.

ELECTRICAL PLANT IN CHINA

There is a growing demand for electrical plants and machinery in China, according to the figures just presented to the rate-payers of Shanghai by the engineer-in-chief of the electricity department of the Municipal Council. One of the most interesting features of the report is that which deals with the growth of the demand for current for both lighting and power.

In December, 1918, the engineer-in-chief reported on the probable demands over a period of six years ahead. This estimate was as follows:

Year	Estimated Demand
1919	29,000 kilowatts
1920	24,000 kilowatts
1921	39,000 kilowatts
1922	45,000 kilowatts
1923	53,000 kilowatts
1924	58,000 kilowatts

In the same period the engineer-in-chief considered the capacity of the plant should be increased from 38,000 kilowatts in 1919 to 83,000 or 103,000 kilowatts in 1924. Since that report was issued the demand for current and the growth of Shanghai have been such that one year later—December, 1919—the engineer-in-chief is compelled to revise his previous estimates as follows:

Year	Estimated Demand
1919	29,000 kilowatts
1920	45,000 kilowatts
1921	64,000 kilowatts
1922	80,000 kilowatts

PORTLAND IS HOST TO SHRINERS

Electricity played a dominant role in the success of the mammoth Shrine convention held in Portland the latter part of June, when 75,000 Shriners from all corners of the country trekked the hot sands to the oasis Portland to attend the annual convention of the A. O. N. M. S., which was declared to have been the largest and most successful convention in the history of Shrinedom.



The above shows how the lamp posts on the streets of Portland were converted into a grove of palm trees

Portland was bedecked in gala attire in honor of the coming of the Nobles of the Mystic Shrine, many unusual and striking decorative features embodying the Shrine emblem and colors, having been worked out.

Ornamental lamp posts were converted into palm trees; streamers with translucent fezzes, with an electric light inside, were suspended at intervals of 25 feet over the streets throughout the business section; the bridges over the river and many of the office buildings were outlined with colored lights; colored steam jets; the Shrine emblem worked out in the form of electric signs; an electric parade with 15 magnificent electric floats, etc., all combined to make a gorgeous illuminating effect.

Visitors to the city during the convention numbered over 100,000.

Seventy-five special trans were required to move the delegates to and from the convention, making a special train arriving and departing, before and after the convention, on an average of every twenty minutes.

A special Shrine telephone exchange handling an average of a call every second during the 24 hours of the day,



The great Shrine arch erected across one of the main streets made a dramatic entrance to an elaborately bedecked and lighted section of the city. The use of colored electric lights and steam jets increased the beauty of this arch during the evening hours.

connected the various Shrine headquarters, the special trains and the exchanges of the local Bell system.

Seventy-five special trains were required to move the drilling en masse on Multnomah Field, presenting a most gorgeous spectacle, and said to be the largest aggregation of uniformed bands ever assembled.

An evening dress parade requiring three hours to pass a given point. The Al Kader temple of Portland had the largest representation in this parade, having over 1000 marchers all in full dress suits.

FEDERAL POWER COMMISSION HOLDS CONFERENCE

The recently formed Federal Power Commission is holding a conference at the present time with outside advisers, for the purpose of aiding in drafting rules and regulations and forms of applications and permits to be used by the Commission. The N. E. L. A. was represented by Franklin T. Griffith, president of the Portland Railway, Light and Power Co.; W. A. Brackenridge, vice-president of the Southern California Edison Co.; G. W. Talbot, president of the Pacific Power and Light Co., and other members of the Water Power Development Committee. Among others who attended or were represented at the conference were: Newton D. Baker, Secretary of War; John B. Payne, Secretary of the Interior; Edwin T. Meredith, Secretary of Agriculture; Major-General Enoch H. Crowder, Judge Advocate General, and Major L. W. Call, who is acting as counsel for the commission.

The responsibility for much of the detailed administration of the Water Power Bill will rest with Oscar C. Merrill, formerly chief engineer of the Forest Service, who has been appointed executive secretary of the commission, and the engineering surveys will be placed in the hands of Lt.-Col. William Kelly, engineer officer of the commission. Both of these men are well known throughout the West, Mr. Merrill for the work accomplished while in the forest service in charge of the Western District, and Colonel Kelly for the great work done while in charge of inland waterways in the Western Department of the United States Army.

COURSES IN TECHNICAL SUBJECTS

Chemistry, electricity, shopwork—three courses of practical laboratory training in technical subjects, are being given by the Extension Division of the University of California in San Francisco. The classes meet in the San Francisco Polytechnic High School, Frederick Street near First Avenue, the instruction is given by teachers of the high school and the modern and extensive equipment of the high school's laboratories and work shops is being placed at the disposal of the extension classes. As the students in these three subjects receive chiefly individual attention from the instructors, it is necessary to limit the classes and registrations should be made at once at the San Francisco office of University Extension, 140 Kearny Street.

The class in electricity is under the instruction of Arthur L. Jordan. The class is studying Direct Current electricity, and meets on Tuesday and Friday evenings at 8:15.

The chemistry course, under the instruction of Miss Edith L. Brown, started on Tuesday evening, August 24. This will be a five weeks' course, the class meeting Tuesday and Friday evenings for two-hour sessions.

The shop work class was started on Monday evening, August 24th, with Ralph Weaver as instructor. In this course individual instruction is given and is so arranged that the beginner and the expert machinist may work side by side, each receiving from the instructor directions for the solving of his particular problem and each given the special training, elementary or advanced, that he most needs.

NATIONAL PARKS AND POWER PERMITS

According to a recent ruling of the Federal Power Commission, no permits will be granted within the boundaries of a national park until the opinion of Congress is given on the subject.

The passage and approval by the President of the water-power bill is considered by Robert S. Yard, executive secretary of the National Parks Association, as most unhappy for the parks. He declares that Congress has turned its power over to three men but states, however, that "under the present administration the parks are probably safe."

ADVISORY COMMITTEE OF NORTHWEST ELECTRIC LIGHT ASSOCIATION PRESENTS REPORT

The advisory committee of the Northwest Electric Light Association has presented a formal report and recommendation to the Northwest Light and Power Association that a definite plan of cooperation as outlined by the committee be put in effect as soon as possible. As this matter must have the attention of all Class A members of the Association it will be formally presented to them at the coming convention of the Association in September, and it is hoped that the report of the advisory committee will be adopted and the machinery set in motion for the cooperation of all electrical interests in the northwest.

SIERRA AND SAN FRANCISCO POWER COMPANY MAY PURCHASE PLANT

The power plant and system of the Tuolumne Transmission Company, which operates in part of Tuolumne county, is to be purchased by the Sierra & San Francisco Power Company if approval of the transaction is granted by the Railroad Commission. The approval is asked for in an application filed by the Sierra Company and the Pacific Gas & Electric Company which is operating the Sierra Company under lease. The price of the plant, according to the sale agreement, is \$13,600.

The Tuolumne Company operated a generating plant known as the Clavey River power house. The plant broke down in 1916 and since then its customers have been served with energy purchased from the Sierra Company. The Tuolumne Company is not financially able to make necessary repairs and for this reason the purchase of the plant by the Sierra Company will prove of public benefit.

NORTHWEST IRRIGATION CONGRESS

The call has been issued for the convening of an irrigation and development congress to be held in Seattle, September 16 and 17, to be composed of delegates from the states of Oregon, Washington, Idaho, Montana and Wyoming. An educational program will be promulgated having for its purpose a vigorous campaign to secure speedy appropriation by Congress of funds for reclamation of arid lands of the West. It is a meeting of the greatest importance and it is expected that all of the states mentioned will be represented by a strong delegation. Chambers of Commerce will be represented by delegates and are giving every possible assistance to aid the success of the congress.

THE NEW INTERNATIONAL CHAMBER OF COMMERCE

The work of setting up the machinery of the newly organized International Chamber of Commerce is now under way in the temporary headquarters, at 33 rue Jean-Donjon, Paris. The permanent headquarters, which will be determined by the board of directors, will probably be located at the seat of the League of Nations. The electrical industry is interested in the recommendation to hasten the use of hydroelectric power in every way.

The outlook for the business "League of Nations" is very promising, according to American delegates who have returned to the United States from the Paris conference where the International Chamber was formed. They report that no more earnest group of men ever met for a greater cause than the 500 delegates from France, Italy, Belgium, Great Britain and the United States—the five foundation countries—who gathered for the purpose of building the machine which would be set in operation to deal with commercial problems between the nations.

American delegates point out that never before had the business interdependence of the world's commerce and the acute character of many of the pressing commercial, financial and economic problems been formally recognized. Nor had

there ever been such a serious and united effort made to find common ground on which unity of thought and action might take place.

An idea of the broad extent of the work which the International Chamber means to cover may be gleaned by mentioning some of the points which were included in the program of the conference, as follows:

- To make import and export trade easier.
- Safeguard international trade against unnecessary waste and fraud.
- Standardize international documents, practices and laws affecting commercial intercourse.
- Remove international friction, much of which begins with commercial differences.
- Increase the total production of the world, and make the product available to the people of the world.
- Increase the mutual profit in international transactions thereby promoting international friendship which is the basis of peace.
- Cultivate personal friendship between business men and bankers of different nations, thus reducing prejudice and misunderstanding.

The following recommendations were made to all countries:

- To hasten the utilization of hydroelectric power in every possible way.
- To hasten the carrying out of the measures which tend to have mineral fuel used in the most scientific and economic way.
- To develop to the utmost the coal resources of the world.

TRADE NOTES

Court Decision —

The Coolidge Wrought Tungsten patent, under litigation for nearly five years, has been declared valid and infringed in a decision handed down late last week by Hugh M. Morris, Judge of the United States District Court, in the matter of the suit brought by the General Electric Company against the Independent Lamp and Wire Company of New Jersey.

Contracts for Electrical Installations —

NePage, McKenny Company, electrical engineers, contractors and manufacturers, Armour Building, Seattle, have recently secured contracts for complete electrical installations in numerous buildings in that city. Included in the list are the four-story Hardeman Hat Company building, West Seattle, Beacon and Greenwood telephone exchanges, Greenwood school, East high school annex and Lincoln high school, new National Bank of Commerce building and the two-story addition to the Arcade building. They also have the contract for installation of a 6600-volt pole line from Buckley to Spiketon, Washington, in connection with Pierce County Coal Company properties.

Representative to Locate in Seattle —

The Electric Storage Battery Company announces the appointment of George D. Luther as soliciting agent with offices at 811 White Building, Seattle. Mr. Luther joined the sales forces of the Boston office of The Electric Storage Battery Company in 1907. In 1910 he was made soliciting agent in Denver in which capacity he served until his recent appointment.

Statement Regarding Battery Company—

Recent advertisements of the Westinghouse Union Battery Company, Swissvale, Pa., have, unfortunately, led many to assume that the Westinghouse Electric & Manufacturing Company was entering the storage battery field. In order to clear away any misunderstanding, the Westinghouse Electric & Manufacturing Company authorizes the statement that the Westinghouse Union Battery Company is owned and controlled by the Westinghouse Air Brake Company, Wilmerding, Pa., and the Westinghouse Electric & Manufacturing Company is not in any way connected with the manufacture, sale, distribution or service of its product.

Change in Sales Department —

B. A. Plimpton has tendered his resignation as sales manager with the Locke Insulator Manufacturing Company of Victor, N. Y., and his resignation has been accepted as effective August 15th. D. H. Osborne is for the present acting sales manager with this company.

LATEST IN EVERYTHING ELECTRICAL

(The rapidly increasing popularity of the one-man street cars makes the safety panel described on this page of more than usual interest since it is especially adapted to one-man operation. There are always on the market a myriad of new devices for the automobile, yet there is always room for such a well designed light as the one shown here. The story of how increased production and comfort are made possible through the use of electrically heated pattern plates is also told on this page.—The Editor.)

SAFETY PANELS FOR SAFETY CARS

The Brooklyn Rapid Transit Company recently placed with the J. G. Brill Company, Philadelphia, an order for 200 safety cars, which is the largest order ever given for this type of equipment. As is well known, these cars are for one-man operation and hence must be equipped with highly spe-

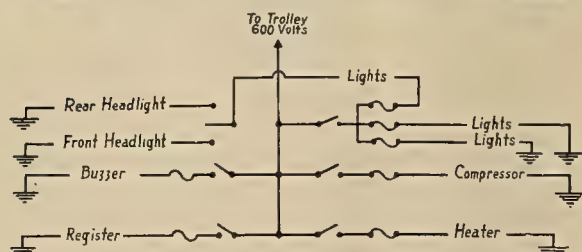
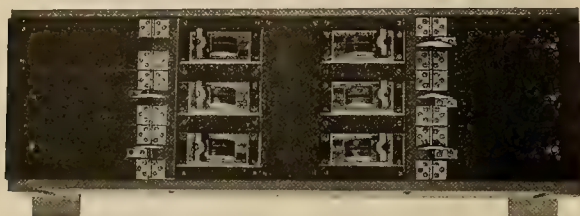


Diagram and photo of the safety control panel which has been used successfully on cars for one-man operation

cialized apparatus in order to insure easy, and at the same time absolutely safe, control.

Among the interesting details of the equipment of these cars are the safety control panels, which were specially designed by the Krantz Manufacturing Company, Brooklyn. These panels are of the Westinghouse-Krantz safety type for 600 volts, somewhat similar in design to those in use in the subway cars and stations of the Brooklyn Rapid Transit and New York Municipal Railway companies.

Each panel is mounted above the vestibule window within easy reach of the operator and carries six switches controlling, respectively, the car lights, compressor, heater, head lights, buzzer, and register. Each switch is mounted in a separate compartment with a bakelite-micra cover and molded asbestos composition sides which form arc shields between adjacent switches. N. E. C. fuse connections for each switch are also mounted in individual compartments.

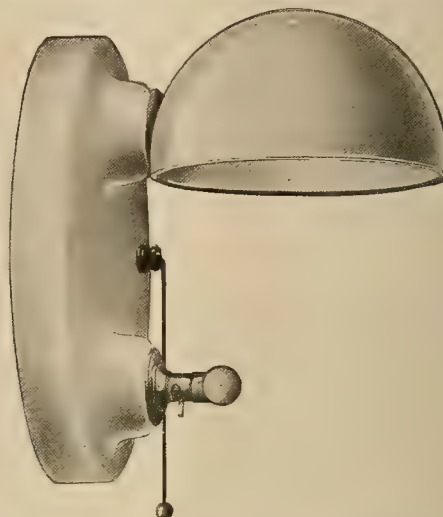
The design is such that not only is it impossible for the motorman to touch live parts when operating the switches but the cover of each fuse compartment is so inter-locked with the corresponding switch that it can be opened only when the switch is off and all reachable parts dead. Hence there is no possibility of injury in handling the panel.

The switches are of single-pole, double-break, quick-break, brush type with brushes protected by arcing tips. All are single throw except the headlight switch which controls the headlight at each end of the car and is therefore double throw.

Service conditions demand that the size and weight of the panel be kept to a minimum. Its dimensions are 30½ by 10 by 4½ inches and its weight 45 lbs.

NEW AUTOMOBILE LAMP

This new auxiliary is a two-candlepower, six-volt automobile lamp, operated in connection with a transformer in-



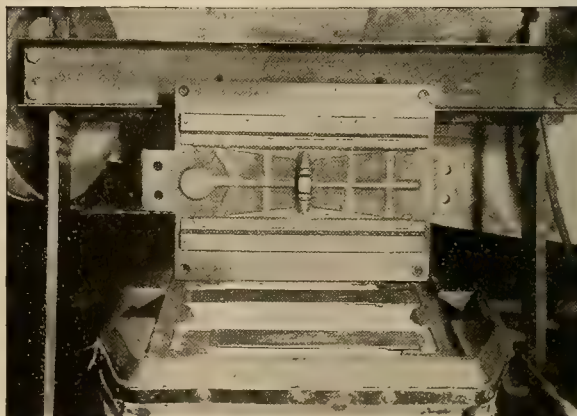
The above is one of the Aglite lamps manufactured by the Luminous Unit Company, division of the St. Louis Brass Manufacturing Company

corporated in the base. This is for alternating current only, 110-115 volt, 60 cycles.

The size bulb used here is available anywhere and its average life is comparatively long. The current consumption of the auxiliary lamp and transformer is negligible.

METAL PATTERN PLATES ON MOLDING MACHINES

The production of clean, smooth castings from molds made with metal patterns depends upon there being no sticking of molding sand to the patterns when they are removed from the sand. There is a tendency for moisture to collect on the cold metal pattern from the moist sand, or for the cold plate to "sweat," during which process moisture collects on it. When this moisture collects, the sand sticks to the pattern being removed from the mold, and the mold acquires a rough surface, so that when the metal is poured, the casting



The electrically heated metal pattern plates which the Westinghouse Company has developed for use on moulding machines.

will have a rough surface. This pattern will now have a rough surface due to the adhering sand, so that when the next mold is made, it will have a rough surface unless the pattern is cleaned off and dried. This trouble is experienced summer and winter.

The collection of moisture can be prevented by heating the pattern. The heat applied, however, must not be so great as to cause the sand in the mould to dry, as it would then crumble away and again the casting would have a rough surface. Furthermore, the heat must be applied in such a way that the pattern can be conveniently changed when desired.

The usual method of heating is by means of a gas flame left burning in the space underneath the pattern within the framework of the molding machine. It is difficult to keep the flame low enough so that it will not heat the pattern too much. A larger flame than necessary is, therefore, employed at some distance from the surface of application. This makes an inefficient arrangement, as most of the heat is dissipated into the surrounding space. The surrounding air becomes contaminated by the gas fumes, and in summer there is the further discomfort due to the heating of the surrounding air.

Book and Bulletins

A Complete Catalog

Catalog 22, issued by the Benjamin Electric Manufacturing Company of Chicago, comprises a complete listing, descriptions and illustrations of Benjamin electrical specialties.

In addition to the catalog data there is a section devoted to useful information upon illumination requirements and also a chapter setting forth simple rules for laying out lighting plans for the attainment of correct industrial lighting. A numerical index gives full details covering catalog numbers, list prices, package quantities, weights and discount schedules. For convenience the material listed in this catalog is grouped into schedules, with mechanical separators, tabbed for quick reference.

Seven Centuries of Brass Making

This is an exceptionally artistic trade booklet, published by the Bridgeport Brass Company of Bridgeport, Connecticut. A brief history of the ancient art of brass making is given and the early, and even recent methods of production are contrasted with that twentieth century achievement, the Electric Furnace Process.

The important steps in the making of tubes, sheets, rods and wire are described and illustrated. Following a description of the Bridgeport plant there is a discussion of the properties of brass as affected by composition, cold-working and heat treatment with the idea of assisting engineers in drawing specifications.

The publishers state that in the compilation of this work they have deviated from age-old conventions and traditions of the brass industry by making an open book of the practices and processes of brass making.

Turbine Installations

An album of plant installations of impulse and reaction turbines is a recent publication of The Pelton Water Wheel Company. The many beautiful illustrations here presented show Pelton units operating under widely varying conditions of head, volume and capacity. Views are shown of horizontal and vertical turbines of both types as they are used in large generating stations, in automatic and remote control plants and in exciter sets.

The Volt Introduces Itself

The Volt, the new house organ of the California-Oregon Power Company, made its initial bow with an attractive July, 1920, issue. The readers are asked to imagine this little publication as a young Rambler out to see what he can see, his itinerary mapped out by the COPCO transmission lines. He has a healthy interest in everything he sees and while interested and amused in it all, he does not neglect to give it serious consideration, for much of it may have important bearing on his future welfare. This explains the way The Volt plans to function.

Paul B. McKee, Vice-President and General Manager, announces that through this organ the company plans to tell its friends both in and out of the organization what it is doing. He also states that the columns of The Volt are open to all and that the Division Managers will be glad to receive items of interest. The many friends of the California-Oregon Power Company wish The Volt a successful career.

Lighting from Concealed Sources

In order to supply the architect with working information on lighting applications the National X-Ray Reflector Company is presenting a series of plates on the lighting of residences, display rooms, offices and clubs. These include diagrams of the floor plan of the interior in question showing the location of all sources of light. Diagrams of column clusters, lighting pedestals and incandescent bowls are also given so as to show the beautiful and numerous effects which can be obtained by lighting from concealed sources.

Binder to Aid Advertising Campaign

The Sprague Electric Works have issued a special binder which contains advance information for the use of sales forces in the preparation for the Spraguelet Sales and Advertising Campaign which is to begin on September 1st, 1920. This company is presenting a new conduit body line which it regards as a distinct contribution to the art of exposed wiring.

Descriptions and illustrations of the Spraguelet sample board and wall hanger as well as helpful booklets and stickers are found in this binder along with a number of samples of recommended and obviously effective advertising.

This advance information is for the use of salesmen in becoming acquainted with the possibilities of this line and with the publicity backing the company proposes to put behind them.

Engineering Report

Engineering Report No. 303, published by the Electric Service Supplies Company, deals with "Golden Glow" and glass reflectors in their relation to the locomotive headlight question, and presents in concise form a large amount of valuable information in connection with this vitally important problem. It has been divided into individually numbered paragraphs and the whole prefaced by a complete index for easy and quick reference to any of the various matters covered.

The report shows essentially the inherent differences between glass and metal reflectors, as well as between optically correct and optically incorrect (ground and unground) glass reflectors; it treats of the marked superiority of glass over metal reflectors and how through their use the cost of headlight maintenance may be reduced to very low figures; it discusses the costs of glass reflectors, candle power and cost of candle power obtainable from same, as well as the limitations imposed on their production both from the standpoint of actual manufacture as well as cost to consumer. Headlight cases are discussed along broad, fundamental lines and those facts of design and manufacture resulting in low case maintenance are prominently given.

NEW ELECTRICAL DEVELOPMENT

(From the Northwest comes the announcement that work on the Link river dam is to commence immediately and of the installation of a 100-kw. Curtis steam turbine in a big lumber company's saw mill. A report of the breakdown of big generators in the Sacramento plant of the Pacific Gas & Electric Company is among Pacific Central items. The Southwest gives the latest word of the city of Los Angeles on its recent filings for water power rights, while news of notable industrial applications of electricity and of plans for the erection of a two-million dollar reservoir and canal comes from the Intermountain district.—The Editor.)

THE PACIFIC NORTHWEST

PORTLAND, ORE.—The Electric Maid Shop has made application to increase its capital stock from \$3,000 to \$10,000.

PORTLAND, ORE.—The Long Bell Lumber Company plan the erection of several large saw mills throughout the Northwest, which will be partially or entirely electrically driven.

RIDGFIELD, WASH.—Brattlie Bros. Mill Co. are installing a number of motors in an addition to their present saw mill. This company is also installing a three-machine shingle mill.

TACOMA, WASH.—The Consumers Heating Company has been granted permission to erect a plant for furnishing heat to several hundred customers. The cost of the plant is estimated at \$100,000.

PORTLAND, ORE.—The employees of the Portland office of the Western Electric Company enjoyed a pleasant picnic and swim, Saturday, August 7, at their annual picnic held on the Clackamas river.

ST. HELENS, ORE.—The 1000-kw. Curtis steam turbine for supplying the energy for the electric drive for the St. Helens Lumber Company's saw mill has arrived, and installation work will proceed as rapidly as possible.

WOODLAND, WASH.—The Woodland franchise and equipment of the Washington-Idaho Water, Light & Power Company has been sold to the Lewis River Light & Power Company, who contemplate rebuilding the city lines as well as making other extensions and improvements.

BANDON, ORE.—A survey is being made for the new 1000-kw. lighting plant and 18-mile transmission line to be constructed at this point. The city has made application to the state engineer for permission to appropriate 25 second-feet of water from Wilson Creek for developing power.

SALEM, ORE.—Application has been made by R. J. Hendricks of Salem for permission to construct a reservoir to store 1500 acre-feet of water, from Trask river in Tillamook county, and for use of 1000 second-feet of water from the above reservoir and Trask river for developing power.

KLAMATH FALLS, ORE.—Work on the Link river dam, which will control the storage of the upper Klamath Lake, according to the announcement of J. C. Thompson, division manager of the Northern California-Oregon Power Company, is to be commenced at once. The dam is to cost \$8,000.

REEDSPORT, ORE.—At a special election on August 14th the Reedsport charter was amended so as to permit the issue and disposal of 25-year general obligation bonds, in an amount not to exceed \$50,000. The proceeds will be used to construct and maintain an electric light and power plant.

SALEM, ORE.—Frank Readen, of Bay City, asks permission to construct a reservoir for the storage of 10,000 acre-feet of water from Wilson river, and for permission to appropriate 1,000 second-feet of water from this reservoir and Wilson river for power to be used in the operation of a pulp mill.

SALEM, ORE.—The city of Toledo has filed application with the state engineer for permission to appropriate 300 second-feet of water

from the Siletz river, for domestic, manufacturing and power purposes. An impounding dam and 19 miles of pipe line will be constructed. The project is estimated to cost \$250,000.

SALEM, ORE.—W. H. Ales has applied to the state engineer for permission to appropriate 300 second-feet of water from Foley creek, tributary to Nehalem river, for power purposes. A flume 60 feet long, with dam and turbine, will be installed at a cost of \$2,000. The applicant is evidently mistaken in the quantity of water he requests as he intends to develop but 50 hp.

WASCO, ORE.—The Sherman Electric Company will soon begin construction of 37 miles of 22-kv. transmission line, to serve the towns of Wasco, Moro and Grass Valley, as well as farmers along the route of the line. The new line will be supplied with power through a 66 to 22-kv., 500-kv. step down transformer at Dufur, where power will be purchased from the Pacific Power & Light Company.

YAKIMA, WASH.—C. F. Wilson, city engineer of Yakima, presented a report on the cost of the proposed municipal irrigation system, which he figures at \$400,000. It is planned to construct the system, which will cover the entire residential district, this fall and winter, so that it will be ready for the growing season next year. The improvement will be paid for through bonds issued on local improvement districts.

SALEM, ORE.—Roy E. Swigert of Montague, Siskiyou county, Cal., as trustee for the proposed Klamath-Shasta Valley irrigation district, has made application to state engineer Copper for a permit to appropriate 1,500 second feet of water from Klamath river for irrigating 150,000 acres of land and for developing power. The main canal is to be forty miles long. Other details of construction have not been determined.

YAKIMA, WASH.—The terms and form of the proposed Yakima irrigation district's contract with the United States reclamation service, which provides that the latter supply the district with 150,000 acre-feet of water yearly upon completion of the Rimrock storage reservoir, was approved recently by the Government. The irrigation district comprises 45,000 acres of land at Wenas, Moxee and Selah valleys. The cost of the storage will be \$1,040,000, which will be paid in 40 semi-annual payments.

SEATTLE, WASH.—The Seattle offices of the Western Electric Company have begun appointing distributors and dealers in the Northwest to handle Titan automobile storage batteries, which equipment is now being distributed exclusively by this corporation. The Seattle offices will have under its jurisdiction all of Oregon, Washington and Alaska, the western half of Montana and northern half of Idaho. Plans have been formulated for going after business in this field in a masterful and efficient way.

THE PACIFIC CENTRAL DISTRICT

ALAMEDA, CAL.—The Alameda municipal electric plant netted \$71,000 profit during the last fiscal year and still provided current at pre-war rates.

TERRA BELLA, CAL.—E. R. Clemens, secretary of the Terra Bella irrigation district, is seeking bids for drilling wells and pump and motor equipment.

SAN FRANCISCO, CAL.—The Pacific Gas & Electric Company has a crew of surveyors at work at Spring Gap, below Strawberry, planning for the construction of a \$2,000,000 power plant.

ARBUCKLE, CAL.—A pumping plant which will cost over \$11,000 will be installed at the Brown-Sullinger-Knox orchard, two miles south of Arbuckle. Seventy-five acres of almonds will be irrigated.

BERKELEY, CAL.—The Southern Pacific Company has awarded the contract for the rehabilitation of the track of electric line between Berkeley and Albany to Hutchenson Co., 17th and Broadway, Oakland, for \$160,000.

FRESNO, CAL.—Fresno was without electric power and light for five hours recently as the result of a fire that broke out in the garage of the San Joaquin Light & Power Corporation on Fresno Street. The damage to the power plant was estimated at \$5,000.

REDDING, CAL.—Power is so low the P. G. & E. cannot keep the pumps going to capacity at the Redding waterworks. Sprinkling of lawns and irrigation in all forms were recently forbidden for two days so enough water could accumulate in the reservoir for domestic and fire purposes.

FRESNO, CAL.—The San Joaquin Light & Power Corporation will spend \$140,000 in the erection of new buildings to replace those recently destroyed by fire. The engineering department of the company is preparing the plans, which will be completed shortly, and work will start within the next ten days.

EUREKA, CAL.—Contracts for building the concrete dam at the intake of the Eureka Water Works on Elk River and for putting concrete covering on the 700 feet of exposed wooden stave pipe have been awarded by the city council. The Mercer-Fraser Company secured the contract for the dam on their bid of \$4995, and Elsmore & Jacobs for the pipe covering on its bid of \$5300.

SAN FRANCISCO, CAL.—E. H. Rollin & Sons are advised that the Great Western Power Company of California first and refunding mortgage 6 per cent bonds, due 1949, have been approved as a legal investment for savings banks in California. The first mortgage 5 per cent bonds, due 1946, of the same company had already been approved and are held by many savings and commercial banks in California.

SAN JOAQUIN, CAL.—Work will start immediately on the construction of a substation in this district by the San Joaquin Light & Power Corporation. A contract has been signed between the power company and the San Joaquin Valley Farm Lands company, the James irrigation district and the Tranquillity irrigation district for the construction of the station and the delivery of power not later than March 1, 1921.

SAN FRANCISCO, CAL.—Conferences with H. G. Butler, state power administrator, were arranged by officials of the Municipal Railroads and the United Railroads, as a result of Butler's order for a general reduction of 20 per cent in the use of electric power, agriculture being the only exception. Superintendent Frederick Boeken of the city lines said that the service would permit of no reduction without inconvenience to the public. He said it might be necessary to

establish turning back points on various outer lines, giving a reduced service in the outermost regions. The power reduction, due to water shortage, must be made between 7 a.m. and 10 p.m.

STOCKTON, CAL.—At a conference in San Francisco between John A. Britton, general manager of the Pacific Gas & Electric Company, and Mayor A. C. Oullahan of Stockton, tentative overtures were made recently for the purchase by the city of the local water plant operated by the company. As a result of the conference it is probable that the State Railroad Commission will be asked to survey the Stockton properties of the company and fix a legitimate sale value thereon.

SACRAMENTO, CAL.—Tentative plans of Colonel R. B. Marshall of the United States Geological Survey for irrigating practically the entire interior of California through the means of water storage and a gigantic canal system, starting at the proposed dam site of the Iron Canyon Project in Tehama county, have been outlined before the Sacramento Valley Water Users' Committee on Organization which met here for the first time. While admitting his scheme is one of the most comprehensive ever proposed and would cost millions of dollars, he expressed the belief that the project is not only feasible but probably the only permanent solution of the water shortage problem.

SACRAMENTO, CAL.—The breakdown of the big generators in the Sacramento plant of the Pacific Gas & Electric Company reduces the source of the electric supply of the main system extending from Shasta to San Francisco by 10,000 horsepower, or more than 7,000 kilowatts. So serious is the trouble, with a threatened shortage of the local plant for several months while new equipment is ordered and installed, that officials of the company were forced to visit Sacramento for the purpose of making an investigation. They included President Creed, P. M. Downing, vice-president in charge of the electrica lequpiment, and John A. Britton, vice-president and general manager. Although the drum power plant in the mountains near Grass Valley has been started, following a shut-down of two months, the breakdown of the Sacramento unit seriously menaces the mining districts, which need power for their machinery. Further curtailment of power to irrigatoinists throughout the Sacramento valley also is considered probable.

THE PACIFIC SOUTHWEST

GALLUP, N. M.—The question of constructing a reservoir is being agitated by the Bluewater people.

SIERRA MADRE, CAL.—A public comfort station will be constructed in the proposed Pacific Electric Railway station.

SAN FERNANDO, CAL.—The board of trustees are planning to increase the capacity of the reservoir 323,000 gallons, by raising its walls sixteen inches.

RIVERSIDE, CAL.—The engineer and superintendent of the water department have been instructed to prepare estimates of the cost of the pumping plant, sinking of wells and laying necessary pipe lines.

LONG BEACH, CAL.—A bond election will soon be called to vote on \$1,000,000 harbor bonds, with which it is proposed to dredge Channel No. 3 and the turning basin to a depth of 25 feet, to widen Chinnel No. 3 and do a large amount of bank protection.

PASADENA, CAL.—Further offerings of municipal bonds were announced by the Harris Trust and Savings Bank, E. H. Robbins & Sons and the National City Company, in an issue of 4% per cent Pasadena Electric Light system bonds. The bonds will yield 5.81 to 5.60 per cent according to maturity. The issue amounts to \$222,000.

MESA, ARIZ.—A petition asking for the organization of an irrigation district, to be named

the Auxiliary Eastern Canal Irrigation District and embracing several thousand acres of land lying east of the Mesa, has been approved by the Board of Supervisors and the date of election for approval set for September 4th. Canals and distributive systems are to be built and operated by the district under contract with the Salt River Valley Water Users' Association.

SAN DIEGO, CAL.—The engineering and irrigation experts and the representatives of allied interests throughout the Southwest met recently for a conference with Arthur P. Davis, director of the reclamation service of the United States. An entire day of discussion ended in the unanimous agreement that the mammoth project of the Boulder Canyon dam on the Colorado river, with the attendant power and irrigation development, should be thoroughly investigated and that the report upon it be presented to Congress next fall and carry with it the hearty endorsement of civic, irrigation and state organizations throughout the Southwest.

LOS ANGELES, CAL.—No interference will be made by the city of Los Angeles if officials of San Francisco file a protest against the claims made by this city to the headwaters of the Tuolumne and Merced rivers and Yosemite creek as a source of hydroelectric power, it has been announced by officials of the Public Service Department. Special Counsel W. B. Mathews of the department said that Los Angeles has no intention of pressing any claim to the water of any stream that may interfere in any way with San Francisco's municipal enterprise. He pointed out that one of the city's filings is on the Tuolumne river and Return creek, while the other filing is on the south fork of the Merced river and Illilouette creek in Mariposa and Madera counties. The latter filing covers a possible power plant site above the Vernal Falls in the Yosemite National Park. President Robertson and Mr. Mathews say that these filings are only preliminary, and made to determine the possibilities and opportunities, in accordance with the department's plan for the future development and expansion of the Los Angeles power project.

THE INTER-MOUNTAIN DISTRICT

VERNAL, UTAH.—The Uintah Telephone Company of Vernal has petitioned the Public Utilities Commission of Utah for an increase in its rental rates.

BOISE, IDAHO.—The Idaho Power Company has begun the preliminary work of building an additional high tension transmission line from its generating plant at Thousand Springs to Caldwell.

MAGNA, UTAH.—The town of Magna has just inaugurated its new twenty-two-mile street lighting system, which was the occasion of a celebration including a banquet, at which the commissioners of Salt Lake county were the principal speakers.

RUPERT, IDAHO.—The engineering and maintenance of the seven pumping stations on the north side of the irrigation district were recently taken over by the Rupert Electric Company. Hitherto the work was handled from Burley. A day and night service is maintained.

SALT LAKE CITY, UTAH.—According to Ralph R. Woolley, hydraulic engineer of the water resources branch of the U. S. Geological Survey, there is a splendid chance that congress will favorably consider the Western reclamation bill for \$250,000,000 for irrigation in the Western states.

SALT LAKE CITY, UTAH.—Members of the congressional committee who recently inspected the proposed project of the construction of the American Falls reservoir, for the irrigation of 1,000,000 acres of land, were favorably impressed with the possibilities, and the outlook is exceedingly encouraging. Irrigation companies have contracted for a large portion of the water which will be impounded.

VIRGINIA CITY, NEV.—By virtue of an order from the U. S. Reclamation Service the Nevada Valleys Power Company cannot further furnish power to Hazen, Toy, Toulon, Rochester, Packard and Mill City, all the available power being required to supply the needs of Fallon, which has prior rights under an old contract with the government.

CARSON CITY, NEV.—The Truckee River General Electric Company has applied for authority to discontinue its electric transmission line from Bluestone Mine Station to Pine Grove. Protests have been made by consumers and a hearing will be held before the Public Service Commission on September 7.

SALT LAKE CITY, UTAH.—It has been officially announced by the local representative of the International Brotherhood of Electrical Workers that their strike in Salt Lake City and Ogden is over. The vote to strike was taken January 13th and the vote to declare off the strike was taken August 16th.

SOLDIER SUMMIT, UTAH.—The Utah Power & Light Company is extending service to a number of new homes in Soldier Summit, which is a new railroad town on the D. & R. G. The D. & R. G. railroad company is to build a 40-room addition to the hotel and also construct 50 additional cottages, in addition to the homes which have already been built to take care of the families of men who have been permanently assigned here.

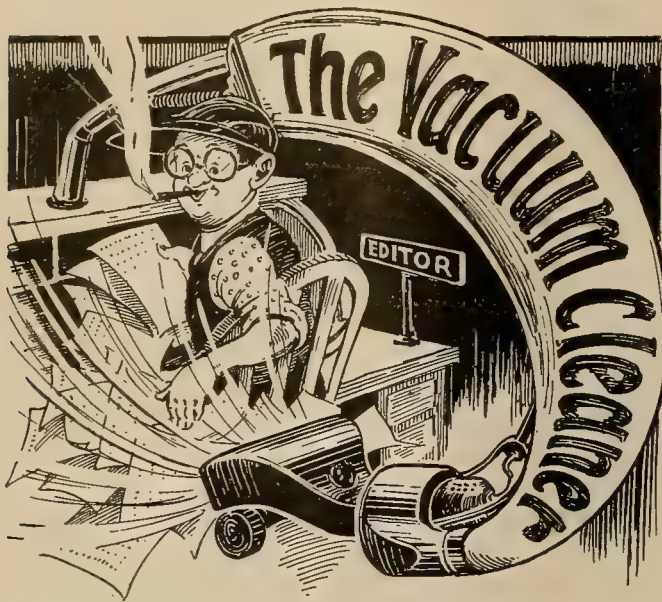
SALT LAKE CITY, UTAH.—Extension of Salt Lake's "whiteway" on Main Street to State, Broadway and Fourth Streets has been definitely put into effect by the city commission creating three new lighting districts. Petitions requesting the creation of the new lighting districts were filed with the city commission early in May, and were referred to the legal and engineering departments. The creating of the new districts is the outcome of these petitions.

RENO, NEV.—To assure permanent relief to the water users of western Nevada dependent upon the Lake Tahoe storage, and to bring about reclamation of at least 50,000 additional acres in this section, Governor E. D. Boyle and State Engineer Scrugham have proposed to the reclamation service that a large storage reservoir be constructed near Reno to conserve the flood waters of the Truckee river. Cost of the reservoir and main canal system is estimated at \$2,000,000.

SALT LAKE CITY, UTAH.—There appears to be considerable likelihood that an irrigation company will be organized to provide water for the district of 30,000 acres south and west of Utah Lake, thereby increasing the production of one of the most fertile areas in the state of Utah and one easily susceptible of irrigation. The plans would require the abandonment of the present pumping plant of the Mosida project, and the installation of another electrically operated pumping plant south of Pelican point, on the west shore of Utah lake.

SALT LAKE CITY, UTAH.—Appeal has been taken by the Telluride Power Company from the decision of the state engineer, refusing to grant further extension of time to the company to make proof of appropriation of 40 second-feet of water from Beaver river. The case will be tried in the court of the Fifth judicial district. Proof was made that expenditures of \$30,000 had been incurred in 1918 and \$25,000 in 1919. It was urged that two years' additional time would be required to conclude the power development, and an indefinite extension of time in which to prove up on the application as originally filed, was asked.

MURRAY, UTAH.—Utah's first zinc smelter, now nearing completion at the station known as Fireside, about a mile north of Murray, will begin operations about October 1st by the Utah Zinc Company, which is constructing the smelter at a cost of \$150,000. This smelter will have an initial connected load of 200 hp.



Being a little sunbeam is a regular career if you give it some serious thought. Says a contemporary:

"Make one person happy each day and in forty years you have made 14,600 human beings happy for a little time at least."

That is all very well, but we believe in large-scale production and modern efficiency if you are going into the business at all. For instance, if you fall backwards into the street car every morning as you start for work, you can make a whole car full of people happy at one fell swoop. If you put your coat on backwards when you go out to lunch at noon you can provide wholesome amusement for the pedestrians on several city blocks; in fact, if you use your imagination and ingenuity you can bring up the total of your victims to far more than 14,600 human beings in a year.

* * *

Big business is at it again. The Railroad Commission records an application by the two owners of a water plant in Orange county, to increase the rate they are charging their one consumer for domestic and irrigation water.

* * *

A whistling locomotive is not merely making itself conspicuous. Every little whistle has a meaning all its own, thus:

One short, sharp blast while train is running—the simplest of all signals and the most alarming. It is addressed to the trainmen and means, "Apply hand brakes. Help me stop." It is given when the airbrakes fail, and with the perfection of modern airbrakes is seldom heard.

Two long blasts—"Release the brakes and thank you." This also is addressed to trainmen.

One long blast followed by three short ones—Addressed to flagman on rear of train and says, "Go back along the track and protect this train so long as we are standing here."

Three long blasts—If given while train is in operation this means that the train has parted.

Two short blasts—This familiar signal from the engineer is an acknowledgment of some signal that has been given for his benefit. It corresponds to "I got you, Steve."

Three short blasts while train is standing—"I'm going to back up."

Four short blasts—This is the engineer's method of asking for instructions or calling for necessary signals.

One long followed by two short blasts—This calls the attention of yard engines of extra trains waiting on sidings to the fact that signals are being carried indicating that another section is following. Unless a reply is received that the signal is understood the engineer will stop his train and find the reason why. Two toots will satisfy him on the subject and nothing else.

Two long whistles followed by two short—Given while approaching public crossings at grade and means "Stop, look and listen, please."

Three long whistles—Given when approaching stations, junctions, railroad crossings at grade and mail cranes located between stations.

Two short blasts three times—This means that the airbrakes are sticking and the engineer wants the train crew to investigate.

Two shorts and one long—Used where there are two or more engines on a train as a signal to transfer air control from one locomotive to another. Two short blasts repeated—Addressed to engineman on second engine and is a request that he assist in recharging air.

A succession of short whistles—This is addressed usually to cattle on the track. It means "— !!! — ?!"

A new scientific law has been discovered by the ex-president of Johns Hopkins. It is as follows: "In any discussion, the heat evolved varies inversely with the knowledge displayed." A writer on the subject continues:

"Expressed as a formula, this law takes the form K equals $C-K$, in which C is a constant, the value of which depends upon the units used for H and K .

"In order to determine the value of C , I recently performed, with the help of the Professor of Heating and Ventilation and the Professor of Political Science, an experiment on two speakers at a debate on the League of Nations. The heat evolved was determined by directing a measured quantity of air at a given temperature against the speakers and noting its increase in temperature; the knowledge displayed was determined by the Professor of Political Science.

"As a result of this experiment, I am able to announce that when the heat units are expressed in B.t.u. and the units of knowledge in ounces, the value of C becomes 1. Applications are simple. It is estimated that a million B.t.u.'s are evolved in the course of one afternoon of debate in the United States Senate. Substituting this value in the above equation, the value of K becomes one one-millionth of an ounce."

* * *

Electrical phenomena accompanying a severe dust storm in the Middle West are reported in a newspaper as follows:

"Barbed wire fences became charged and one, in an authenticated instance, set fire to dry grass and caused a prairie fire.

"A dog chained to a wire clothes line set up a prolonged howling and when its master tried to unsnap the chain he got such a shock as to reveal unmistakably the cause of the canine's woe.

"Balls of fire, according to cattlemen, formed on the tips of the cattle's horns. A country ranchman reported driving a bunch of cattle through the storm at night with the cattle furnishing a continuous display.

"Automobiles on highways in the western part of the state halted without explanation. Batteries in many instances were burned out and persons touching metal parts received shocks.

"An electrician got his automobile going as usual by letting a wire trail behind the car which grounded the charge.

"Cooking utensils on stoves became so highly charged that housewives had to use flatiron holders or gloves to avoid a shock."

Never a dull moment in very dry districts like this.

* * *

The force of habit is sometimes a very present help in time of trouble, especially if the trouble is of such a violent nature as to shake one's presence of mind. The perfect example of "business as usual" is the hero of the following story. There had been a bad train wreck, and on the relief train rushed to the assistance of the injured passengers was the brisk and inevitable reporter. The first person he saw as he made his way towards the wreckage was a man sitting in the road with his back to a fence. He had a black eye, his face was somewhat scratched, and his clothes were badly torn—but he was entirely calm.

The reporter jumped to the side of the man against the fence. "How many hurt?" he asked of the prostrate one.

"Haven't heard of anybody being hurt," said the battered person.

"What was the cause of the wreck?"

"Wreck? Haven't heard of any wreck."

"You haven't heard of any wreck? Who are you, anyhow?"

"Well, young man, I don't know that that's any of your business, but I am the claim-agent of this road."

* * *

Devotion to duty has a touching exponent in the prominent delegate to an electrical convention who met with an automobile accident, but pulled himself together the following day and appeared in three sections.

IN THIS ISSUE: Power Applications in Western Industry

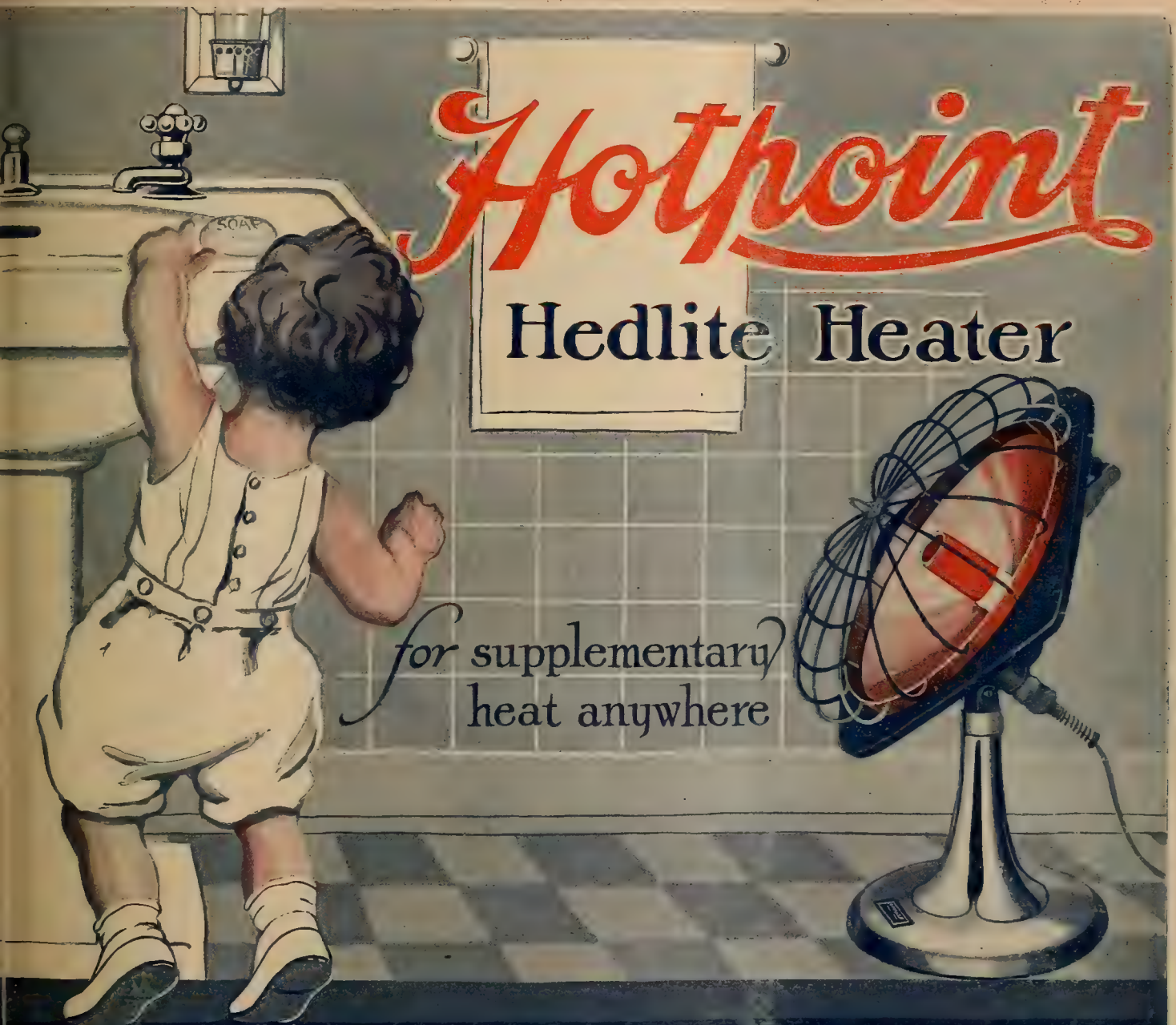
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SAN FRANCISCO, SEPTEMBER 15, 1920

Per Copy, 25 Cents



Hotpoint
Hedlite Heater

*for supplementary
heat anywhere*

The illustration shows a young child with curly hair, wearing a light-colored dress and white socks, standing in a bathroom. The child is looking up at a sign on the wall. The sign is white with a black border and contains the text 'Hotpoint' in a large, red, cursive font, and 'Hedlite Heater' in a smaller, black, serif font. Below the sign, the text 'for supplementary heat anywhere' is written in a cursive font. To the right of the sign is a Hotpoint Hedlite Heater, which is a red, cylindrical electric heater with a black wire cage around it, mounted on a silver-colored stand. The background of the illustration shows a tiled wall and a sink with a faucet.

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JOURNAL OF ELECTRICITY

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VOLUME 45

SAN FRANCISCO, SEPTEMBER 15, 1920

NUMBER 6

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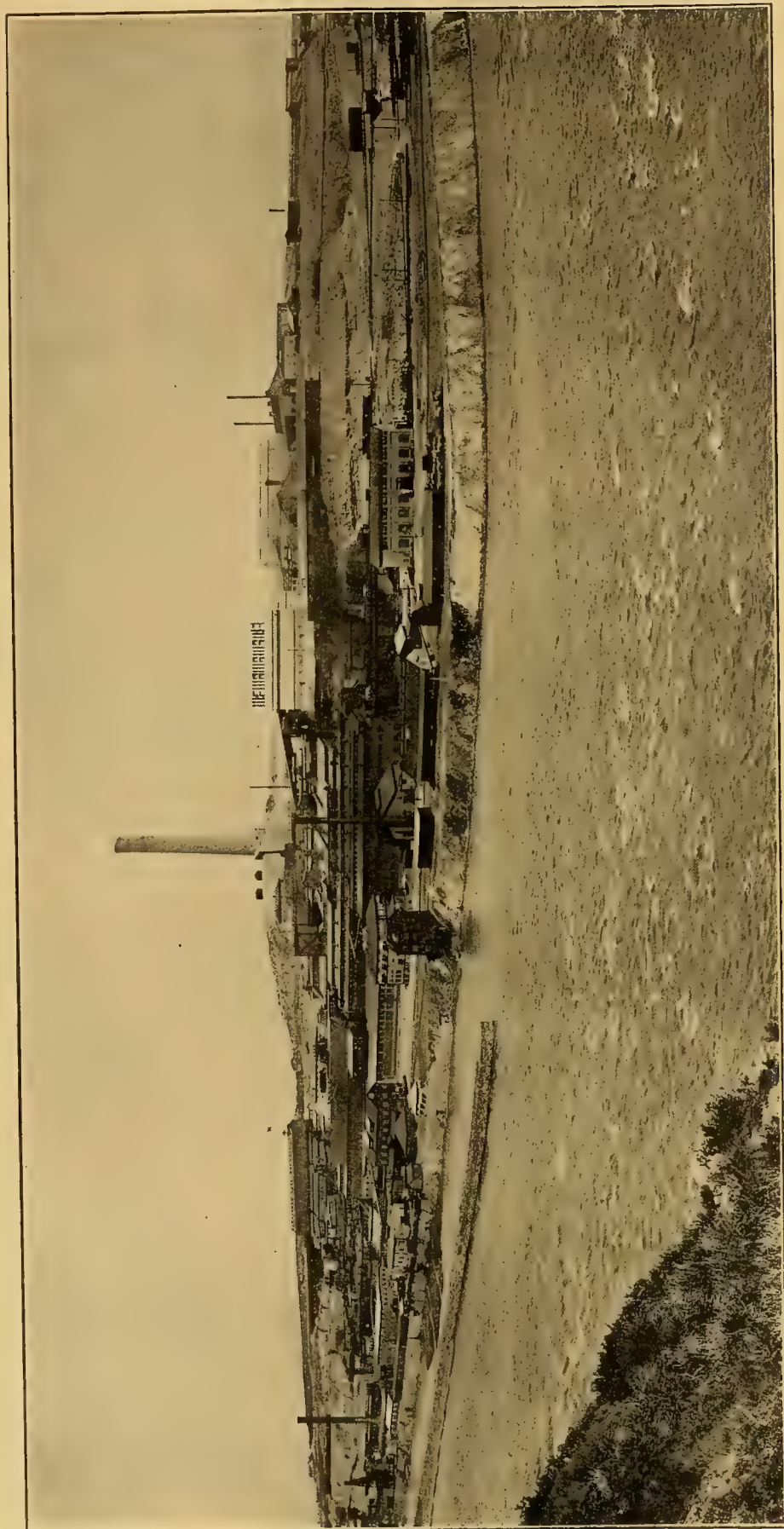
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THE WEST LEADS IN THE SMELTING INDUSTRY

During the past year 2,300,000 tons of copper ore were treated at the Anaconda smelter in Montana, resulting in the production of more than 57,000 tons of copper and of \$8,220,000 worth of gold and silver as a by-product. The daring and foresight that led to the establishment of this industrial achievement, in which electrical energy plays such a prominent part, have made it a fitting monument for the West. It is illustrative of the great dreams that are being expressed in material form, and are making the West, with its forty million undeveloped water horsepower, the logical industrial center of the world.



JOURNAL OF ELECTRICITY



DEVOTED TO THE UPBUILDING OF THE ELECTRICAL INDUSTRY IN THE WEST
AND IN THE COUNTRIES BORDERING THE GREAT PACIFIC

Volume 45

SAN FRANCISCO, SEPTEMBER 15, 1920

Number 6

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The Eternal Question of Private *versus* Public Ownership

An Editorial

The necessity of municipally owned power plants as well as privately owned power plants rendering their accounts to the public in a standard form becomes daily more emphatic. The Journal of Electricity, at the recent Pasadena Convention of the National Electric Light Association, was commended in the highest terms for its national questionnaire published in its issue of May 15th concerning definite reports from the forty-eight states of the Union in regard to this important point. This commendation, coming as it did from the Public Policy Committee of that great Association, adds emphasis to this necessity of the hour.

That certain citizens of towns having municipally owned street car or lighting and power systems are suspicious of the ability of that system to earn a fair return on the money that they as citizens have invested, is evidenced by the attitude of the daily press in those cities. Scathing editorials have appeared in Seattle, San Francisco and Los Angeles papers questioning the balance sheets and reports given out by the municipal officials regarding the earnings and expenses of the municipal systems in those towns. An editorial recently appeared in the Seattle Post Intelligencer entitled "Why Not Be Truthful?" which indicted the Seattle Lighting Bureau on the ground that its previous reports to the public had indicated no deficit and therefore no necessity for the present raise in rates. The Municipal Railway of San Francisco is accused of giving a false impression of its prosperity through a failure to include certain items in its fiscal statement which are required by the law of the privately owned company. In calling attention to these things the Journal of Electricity does not wish to impugn the character of the respective city departments but merely to bring before its readers the necessity for an equal basis of comparison.

This journal has in the past had little to say regarding the relative merits of privately owned as opposed to municipally owned power plants, but insofar as standardized forms of keeping accounts and a just and reasonable comparison of statistics of operation are concerned it has been most emphatic in past issues; and now again wishes to place itself on record as urging all sides to the issue, in a spirit of

fair play, to get together on some common basis of comparison of costs. The most direct and simple method would seem to be to empower the regulating commissions of the various commonwealths to superintend such standard forms of accounts, both for municipally owned as well as privately owned systems, as are required for privately owned utilities, and in a measure has been acquiesced in by the municipally owned utilities in California under the guidance of the California State Railroad Commission.

Without certain standardized comparisons, camouflage and all sorts of subterfuges become possible, and misrepresentation of facts to the public should not for a minute be tolerated. Take for instance, some of the particular points at issue that become confused where no standard of comparison is possible. Even though a municipality could show a lower rate per kilowatt-hour to the consumer than that charged by a private utility, the question of service in territories surrounding the city and upon which the city depends, must also be taken into consideration. In practically all our cities in the West the prosperity of these centers of population depends upon the production of the surrounding country, and the production of the surrounding country depends largely upon the service rendered by the power company. The grocer, the lumberman and others might save a few dollars per month on account of a lower electric rate within a municipally operated territory, assuming that a lower rate were possible under municipal operation; but unless the territory outside that city were served with power sufficient to continue its development those same business interests would suffer a loss in far greater amount of income from this outside business than they would gain in the saving of power.

Take another point that is well worth considering: In the commonwealth of California a corporation tax of 5.6% is now being paid by a private utility that is not being paid by the municipally owned utility. As a consequence, as municipally

Western climate means good working weather for twelve months of the year.

FORWARD WESTERN INDUSTRY!

owned power plants continue to increase the tax will automatically fall upon the rural districts in communities not served by municipally owned plants. A municipality owning its utility by reason of not paying this corporation tax, can reduce its rates to the consumer within that municipality and this additional burden will be loaded upon the farmers and communities being served by private utilities. As statistics show that one farm at the present time is supporting two families in town, it would seem that the farmer is now doing his part without assuming this additional burden which is without justification.

If the city of Los Angeles wishes to sell power to the Goodyear Rubber Company at a figure so low that no one else can outbid her in order that she may land this industry, surely no one else will deny her the right to subsidize industry; but at the same time it is not fair to camouflage the issue and make it appear that this power is being sold at a profit and thus compromise privately owned power companies serving similar communities in the West.

Many other specific instances may be cited in comparisons of this nature, but the main point that it is desired to drive home in this editorial is that by all means a standardized system of accounting, equitable to both privately owned and municipally owned utilities under the direction of a state regulatory body, is beyond the question of a doubt the fairest way to procure unbiased and sane information on this subject, and it is to be hoped that all parties to the issue will join in this movement, voiced by the Journal of Electricity in its issue of May 15th, and see to it that proper laws be instituted in the various commonwealths of the country to bring about this much desired status of affairs.

The program of the Northwest Electric Light and Power Association's convention, recently held in Spokane, Wash., containing as it did two addresses before the public, one to the citizens of Spokane and the other to the Spokane Advertising Men's Club, brings forcibly to mind the necessity of telling the public the big part that has been played in the development of the West by the electrical industry. The report of the Water Power Development Committee presented at the Pasadena Convention of the N. E. L. A. and printed in full in the May 15th issue of the Journal of Electricity should be studied by every member of the electrical industry and the facts contained therein presented to the general public at every available opportunity.

The romance of the daring projects conceived and put into operation by the engineers of the West should be brought out, and the confidence that the men of the electrical industry have in the future of the West, should be shown by telling of the vast sums of money which they are preparing to spend in hydroelectric construction in the next decade. Picture to the public the huge industrial centers which will spring up in the West as the result of the great blocks of cheap power available, contrasting this with conditions in the East, where plants are

now facing the rising cost of fuel oil and coal. Visualize the benefits which the West is to receive from these great projects and bring home forcibly the idea that the development of the West is coincident with the development of its hydroelectric resources. Sell the idea to the public so that when their cooperation is needed it will be readily given.

The Journal of Electricity, the exponent of the West, cannot refrain in passing from commenting upon the optimism that prevails throughout the West over the advent of new industries and the outlook for the future. Perhaps

Optimism Over New Industries For the West

no single incident has brought this thought more before the analytical mind of the public than that of the recent increase of freight rates and its possible effect upon the West. Slowly but surely the conviction grows that these increases will tend emphatically to give impetus to new industries throughout the West. Raw products at home will be manufactured into the finished product or shipped East or across the Pacific to Oriental and Pan-Pacific ports in the finished form in order to save in the cost of production.

Fundamentally, too, the conviction grows that industry has a brilliant outlook in the West due to the vast possibilities of hydroelectric development, 70% of the nation's undeveloped water power being located west of the Rockies. The excess of raw products prevailing throughout the West also adds impetus to possible new industries. Add to this a climate that makes possible a number of working days combined with housing conditions of the best type and a labor market at least no worse than elsewhere, and there are sufficient reasons to convince those who know, that never before in its history was the outlook better in the West for the early advent of new and important industries.

In our last issue there appeared an account of a drive for three and a half million dollar sales for the Great Western Power Company. The interesting part of this situation is the fact that although this company has in the

Great Western Power Company's Bond Sale

past made little effort to market local securities practically the entire issue will be sold in central California. The people of this district are each day becoming more and more convinced of the fact that the state itself will progress no faster than its hydroelectric development, and as a consequence these great utility companies with stock securities offer one of the soundest investments on the market today, and there is great confidence that the regulating commission is being backed up by the people themselves, in the thought that these utility companies, closely guarded and regulated as to efficiency and rate-granting authority by public commissions, should, when faithfully performing their duties, be given a wholesome and generous treatment.

The growing tendency in the West looking toward the uses of higher voltages makes imperative research work connected with transformer oils. That one company has already placed an order for transformers with a voltage capacity of 220,000 makes this need even more emphatic. The dielectric strength, viscosity and other qualities of transformer oils should be given unusual study, since upon the efficient operation of these auxiliaries for transformer service will depend much of the future of high voltage transmission. It is to be hoped that research along these lines will be undertaken by both the American Institute of Electrical Engineers in its western sections as well as the Engineering Committee of the Pacific Division of the National Electric Light Association.

Several successive dry years have brought the state of Montana face to face with the realization that its agricultural prosperity is dependent, as is that of so many other districts of the West, upon irrigation. As in other districts of the West, also, this means gravity irrigation supplemented by electric pumping, a condition which has made the agricultural load of the West one of such primary importance. So pressing is the condition in Montana at the present time, that the Public Service Commission of that state is setting aside all work that it can in order to make an irrigation survey of the state which shall be the basis for a state and national appropriation next year to cover irrigation needs. Montana already is one of the foremost users of electricity through its mines and the railway electrification in which it has been a pioneer—and present indications are that it will soon take its place among the agricultural centers as well.

The vital question of the shortage of fuel oil and coal which is now of nation-wide interest is bringing about economies in the saving of fuel which were unthought-of a few years ago. The convention of the Northwest Electric Light & Power Association recently held at Spokane, Washington, brings forcibly to mind the unique method of conserving fuel used by the Washington Water Power Company's steam plant at Spokane where for some months the excess power of the company to the extent of 5000 kw. has been utilized to heat the feed water for this plant. Another example of the insistent search for new fuel is seen in the news dispatch that the San Joaquin Light and Power Corporation has broken the ground for its new natural gas-burning steam plant in Kern country near Buttonwillow.

Economies in steam station operating practice on the Pacific Coast have been practiced for some time. At Seattle the municipal plant has been equipped to operate under fuel oil supply, but the boilers and furnaces have been placed in such a way that an easy change-over back to coal may be effected. The Puget Sound Power and Light Com-

pany has, during the last year or two, been making exhaustive studies in the subject of how to use pulverized coal and seems now well on the way to successful results. At Portland the Northwestern Electric Company has made use of a steam pressure approximating 250 lb., and at the same time is taking advantage of the refuse from lumber mills by the installation of a hogged fuel plant that is proving unusually efficient in operation. The Portland Railway Light & Power Company is proving equally successful in the use of this new type of fuel.

In central California the two large steam power plants of the Pacific Gas & Electric Company, one in Oakland and the other in San Francisco, in order to improve, have installed special metering facilities, thus bettering their daily operating conditions by economy in the use of fuel oil. At Bakersfield the steam power plant of the San Joaquin Light & Power Corporation has changed over entirely to operation by natural gas which, of all fuels, proves easiest of application, not excepting fuel oil. Farther down in the south in the Redondo plant of the Southern California Edison Company a complete overhauling of boiler room equipment has taken place, and again at the Long Beach plant of this company the installation of metering facilities has materially improved the average operating efficiency.

Over in Arizona the New Cornelia Copper Company at Ajo has, by means of the installation of automatic regulators for fuel oil supply, effected the saving of from 3 to 4 per cent in operating economy, while at the station of the Arizona Power Company at Phoenix, Arizona, the high records in fuel oil and boiler efficiency of 333.3 kw-hr. generated per barrel of oil used has been established.

The statement made by the Hon. E. O. Edgerton, president of the California Railroad Commission, before the N. E. L. A. Convention in Pasadena last May, that power companies should be allowed a bonus for increased efficiency in their plants will give the power companies an unusual incentive to increase their efficiency. If this policy is adopted by the regulatory bodies throughout the nation, it must surely result not only in an increased efficiency in all power companies and a consequent saving of fuel, but it will lead to a closer study of the problems which now confront every company using fuel of any sort in the development of its power.

The United States Chamber of Commerce has taken a really constructive action in expressing its opinion of a compulsory arbitration of all labor troubles which may arise in the operation of public utilities. The recommendation, which was carried by a vote of 1,564 to 97, reads as follows:

"The committee recommends that strikes by employees of all public service corporations performing public service essential to the lives, health, security, comfort and well-being of the people should by law be explicitly prohibited."

Industrial development means a new market in the West for electrical equipment.

FORWARD WESTERN INDUSTRY!

It was further recommended that suitable tribunals be created by law to adjudicate differences between employes and employers and that the decision of such tribunals be final and binding upon all parties.

This action is a refreshing attempt to consider the labor problem at a time of peace and in the interest of its permanent solution, other than as the mere settling of an individual situation. The electric light and power industry on the whole has not been bothered with labor troubles, and in general the spirit of its employes has been one of cooperative service which in itself was a guarantee against strikes; but it must not be forgotten that labor could tie up a city in British Columbia not so very long ago so that it was cut off from light and transportation for several hours, that both northern and southern California have suffered from electrical strikes within the last ten years, and that the entire labor situation is at the present time in a state of more or less restless uncertainty.

It is all very well for the power company to make sure that it is in the right and then win whatever strikes may occur through superior staying powers and the carefully guarded sympathy of the public—but like war, it is better not to have a strike than to win one. The time to worry about mending the roof is when it is not raining—and the labor problem is best handled when it is not acute. What is needed on the labor problem is a little constructive thinking and action in the present which will forestall trouble in the future—and in this the United States Chamber of Commerce seems to be taking a lead which is worth following.

Much interest has been attracted toward the use of the electric locomotive both in the Hetch Hetchy development of the city of San Francisco and in the driving of the Kerckhoff tunnel of the San Joaquin Light & Power Corporation. Particular emphasis may be placed upon the possibilities of the electric storage battery and the electric locomotive in tunnel driving as instanced in the recent completion of the San Joaquin development known as the Kerckhoff project. Here the tunnel was of such proportions that the use of the steam shovel within the tunnel found its first application in the modern driving of tunnels. The electric locomotive supplemented the steam shovel activities by carrying the burrowings from the work into and out of the long tunnel as fast as the shovel could handle it. By the installation of the storage battery, however, upon the locomotive, certain extended uses of the locomotive were made possible. For instance, in the overhaul as the steam shovel progressed in its work there was not always time to extend the use of the regular trolley system, and as a consequence the storage battery proved of great assistance. Indeed, one of the outstanding features of this tunnel development proved to be the expedition with which material was taken from the tunnel, to which the electric locomotive and the use of the storage battery contributed in no small degree.

In view of the large hydroelectric development now going on in the West and the possibility of extended tunnel driving, the storage battery will unquestionably prove of increasing helpfulness.

WHAT IS HAPPENING

in the Electrical Industry in the Northwest, as brought out at the convention of the Northwest Electric Light & Power Association in Spokane, will be featured in the Northwest Convention Echo number of the Journal of Electricity, October 1st. Full reports of the papers, discussion, entertainment, will serve as an indispensable record if you attended convention, and a welcome consolation if you had to miss it.

Ice Making in the San Joaquin Valley

BY J. M. BUSWELL

(The productivity of a fertile district is neutralized unless adequate facilities are provided for shipping the surplus products to other parts of the country. The extensive refrigeration industry which makes it possible for the East to enjoy the fruit and dairy products of California is here described by the general inspector of the San Joaquin Light & Power Corporation, who was also author of the article "Making Ice Cream Electrically," which appeared unsigned in the August 15th issue of the Journal of Electricity.—The Editor.)

The prosperity of the community depends as much on its ability to ship out its product successfully as on its ability to produce it successfully, and ice for shipping melons, fresh fruits, grapes and berries is equally as necessary as the irrigating stream because it at once widens the field in which the product can be distributed.

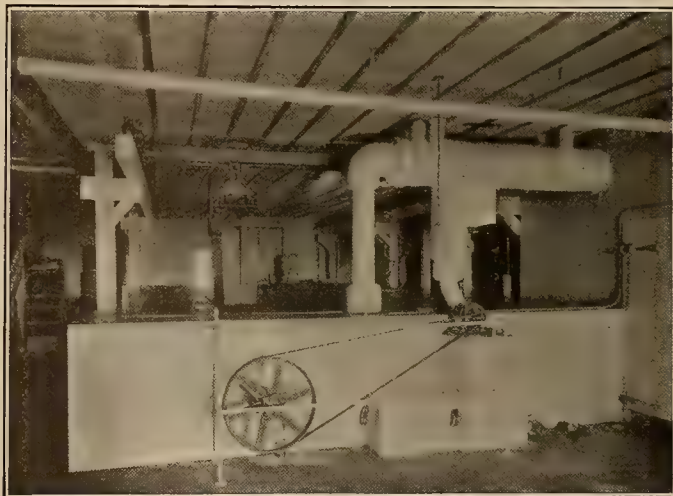
In a great agricultural territory such as the San Joaquin Valley, electricity and the equipment provided for its utilization are required, not alone for the irrigation of the vineyard and orchard, and

journey overland, during which they are re-iced as required, at El Paso and other points.

The list of shipments over long distances from the San Joaquin Valley includes oranges, grapefruit, lemons, fancy table grapes, plums, peaches, apricots, pears, persimmons, pomegranates, nectarines, figs, water melons, turkish melons, cantaloupes, etc., some shippers having their entire crop contracted for by single concerns in the extreme East, while a great many of the melon shipments go north into Oregon and Washington.



400-hp. motor driving duplex ammonia compressor at Fresno Valley Ice Plant. This was the second of four units installed. To the left is a motor-driven air compressor.



An old picture of a freezing room, showing the tilting machine in the center background and a hand-operated can crane. Note the brine agitator belted to the motor.

in the packing house, but also to make successful shipment possible.

Refrigeration Cars for Fruit Products

The largest single industrial consumer on the system of the San Joaquin Light & Power Corporation is the Valley Ice Company, of which Mr. J. R. Erskine is general manager, and which operates its largest plant at Fresno, one at Bakersfield and another at Modesto. The bulk of the product is used in refrigerating fruit cars.

The plants are located on the railroad main lines, the one at Fresno lying between the Southern Pacific and Santa Fe tracks, where they closely parallel each other. Sidings from each have been constructed along the loading rack from which the cakes of ice are pushed into the hoppers of the refrigerating cars. Whole trains of these cars are run in on each side of the rack.

The trains of empty cars are shoved in on both side of the rack at once, iced for precooling, and then taken to the loading stations where shippers have ordered cars. After being loaded with fruit, melons, etc., they are returned and re-iced for their

Other products shipped under ice from the Valley in large quantities are eggs, butter and fresh meats, requiring, in addition, cold storage previous to shipment.

Electric Drive

The Fresno plant of the Valley Ice Company, the largest plant of its kind in the West, is served from the main 60,000-volt lines of the San Joaquin Light & Power Corporation through a separate substation, on the premises, equipped with a bank of 3—667-kva. Westinghouse transformers connected 60,000-volt star, 440-volt delta, with a spare for emergency use and to permit inspection, etc., without interruption.

The plant operates the following equipment:

Two 400-hp. Allis-Chalmers 400-volt, three-phase, 60-cycle, 390 r.p.m. wound rotor motors; one 500 hp. Westinghouse squirrel cage motor, and one 100-hp. wound rotor motor, both 390 r.p.m., used for driving four ammonia compressors.

Local industries mean local homes and local home appliances.
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The smaller units include a 30-hp. motor driving the conveyor on the car-loading rack or platform; four 15-hp. motors on the ice drags or elevators to the platform; a 3-hp. motor on the hoist in the storage house; five 7½-hp. motors driving ice tank (brine) agitators; two 10-hp. motors on the air compressors furnishing air for can pullers, etc.; four 20-hp. motors on pumps for the water supply; a 20-hp. motor on the positive blower for air for "clear ice" air jet agitators; and two 5-hp. motors, one for the shop and one for a car gypsy or winch for moving cars on the siding in the absence of switch engines when loading ice for shipment at the door of the storage warehouse—1660.5 hp. in motors in all.

Refrigeration Process

There are 5326 ice-making cans in which are frozen 300-lb. cakes requiring 32 hours freezing, the regular "can system" being used. These cans are filled in place in the freezing tank, through automatic can fillers which shut off the water when the cans are filled to the proper height. The water is pumped from private wells on the premises.

The sides and bottoms of the cans, during freezing, are surrounded in the tanks by brine which is kept circulated between the cans and the ammonia-expansion coils, also submerged in the tanks, so as to extract the heat from the water in the cans, allowing it to freeze, while the heat is transmitted by the brine to the ammonia coils where, in expanding (evaporating) from ammonia liquid under pressure to ammonia gas at reduced pressure, the heat is absorbed.

The temperature of the brine in the tank is maintained at from 8 to 12° F.

The tops of the cans are each covered by heavy blocks which, when all are in place, form a complete cover over the whole tank during freezing.

Part of the plant is equipped with "clear-ice" making equipment which consists of air agitators placed in each can to agitate the water while freezing, thereby producing clear, crystal ice, which is easily obtained, the water here being exceptionally pure.

The largest portion of the ice made is called "white" ice, used for refrigerating railroad cars, and is made from the same water as is used for making clear ice, but the product is "white" on account of the air being frozen in, instead of being liberated by the air jet agitators.

The pipes are then withdrawn at the proper time and when freezing is nearly complete all impurities are left in the small remaining amount of unfrozen water. This is removed and the crevice filled with fresh water which is allowed to freeze in.

The cans are then lifted out, four at a time, by traveling, compressed-air, direct-acting hoists or rams, two of these (each lifting two cans) being mounted on cross travelers of a bridge or crane which travels the length of the tank.

When the cans are raised to the proper position, the air is automatically shut off and the crane is moved to the end of the tank. The cans are lowered into warm water to melt enough next to the surface

to loosen the cakes and are then raised, moved over, and lowered into tilting machines. Each of these takes two cans and turns them nearly upside down, so that the cakes slide out into inclined troughs and pass through trap doors into the storage room. In this room, which is kept at a temperature of 26° F., the ice is stored until wanted.

Loading Cars

From this storage, delivery is made to trucks for city wholesale delivery, to cars for shipment, and to an elevator which carries the cakes to the long loading rack where they are picked up by a conveyor and carried along the rack, where men are stationed with hooks and picks. Those with hooks jerk the cakes off the conveyor as required, causing them to slide off to the scuttles or hatches on top of the refrigerator cars; the men with the picks jab the cakes as they go down so as to break them, exposing more surface to the air in the car for refrigeration.

Twenty cars can be run in on each side of this rack and loaded in 3.5 hours and, as each siding is open, loading can be accomplished continuously.

Nine thousand cars will be loaded in this way from the Fresno plant this year, requiring 100,000 tons of ice and providing for the refrigerated shipment of 315,000 tons of fruit, etc.

The standard car holds about thirty-five tons of fruit and requires nine to twelve tons of ice in pre-cooling and re-icing.

Demand and Output

Part of this ice is made in winter and accumulated during slack days in summer, and in the past part has been natural ice shipped in from the high Sierras at Truckee, and elsewhere when necessary, although this source is becoming less of a factor on account of demands closer to those fields, and on account of freight conditions and cost. Consequently the ice plants had to be enlarged.

During the past year 110,000 tons of ice were made at the Fresno plant, the peak demand being 1102.12 kw. on the substation and requiring a total of 4,573,633 kw-hr. of electric energy.

The plant now has a capacity of 525 tons of ice per day, and runs twenty-four hours. When a compressor is started in the spring it is generally run continuously till late in the fall. Part of the plant is operated all year.

Thirty-five thousand pounds of liquid ammonia (anhydrous ammonia) is required to fill the ammonia system. It is compressed to 185 pounds per square inch, in a gaseous state, then cooled in coils under a water shower on the room, where it liquifies. After this it is conducted to the "expansion coils" in the freezing tanks and storage rooms, expanding (evaporating) into a gas at about eighteen to twenty pounds per square inch pressure, when it has a volume of about twenty-one times that of the equivalent liquid.

The output last year, the present daily capacity in tons of ice, and the installed horsepower in motors of the larger plants in the valley are:

Name	Location	Output	Capacity	Motor Hp.
Valley Ice Co.,	Fresno	100,000	525	1660
" " "	Bakersfield	70,000	325	1075
" " "	Modesto	70,000	410	1045
People's " "	Fresno	15,000	260*	775*

*NOTE—Increased this year from 60 tons per day capacity to 260 tons per day.

The peak demand in a 500 tons-per-twenty-four-hours plant is about 1100 kw. and in a 60-ton plant about 190 kw., and from 40 to 60 kw-hr. are required in the process of manufacture of a ton of ice in these plants. The load factor is exceptionally high.

The Valley Ice Plants ice the greater part of the refrigerator car shipments and do no retail business, wholesaling to delivery companies in addition to car icing. Other plants furnish ice, principally for cold storage and domestic use, by wholesale and retail delivery.

This industry, which is very important and little heard of, has been making rapid growth: ice consumption in the home, restaurants, hotels, stores and ranch houses has made great strides in recent years, when even drug stores, hospitals and doctors have installed special refrigerators for keeping serums, photographic plates, etc., during hot weather. In addition, the average butcher shop, creamery, large office building and warehouse, are equipped now with refrigerating plants for show windows, storage rooms, drinking water, and so forth.

Ice refrigeration is accomplished by salting down ice in a refrigerating space, the salt causing the ice to melt at a few degrees lower temperature and, heat being absorbed in melting the ice, the space is thus cooled to as low as about 26° in some cases; salt is used only where rapid refrigeration or low temperatures are required.

The central stations may do well to encourage the twenty-four-hour loads in plants where ice refrigeration is not economical and where sufficiently low temperature cannot be attained by ice refrigeration.

A NEW PUMPING INSTALLATION

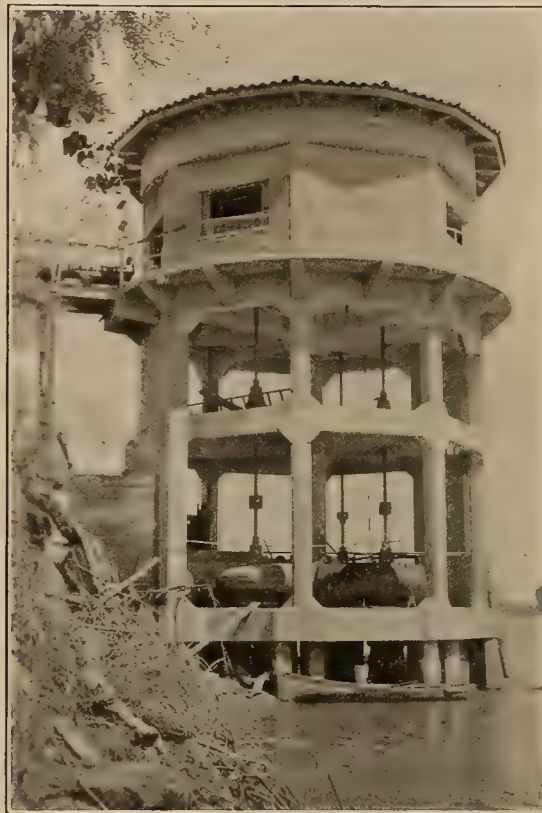
The Conaway river plant which has recently been completed on the Sacramento River is located at Elkhorn in Yolo county, about seven miles due east of Woodland. The plant was erected under the direction of Mr. Fred Tibbetts, civil engineer, who also supervised the construction of the irrigation and drainage ditch system, as well as a couple of other pumping plants that are located at different points on the Conaway land.

The Conaway river plant is a little different from the usual type, as on this installation vertical pumps and vertical motors were used. The building which was erected to house the pumps and motors is octagon shaped, and was erected on concrete piles which were driven into the bed of the river. The pumps are mounted down close to the level of the water so that the discharge pipes from them run directly into a tunnel at the base of the levees to a canal on the inside of the district where the water is conveyed by gravity. In the upper part of the pump house building the vertical motors and the switch boards are installed. The accompanying pho-

tograph shows a view of the pump house which was taken when the Sacramento River was rather low.

During the greater part of the year the pumps which can be seen in the lower part of the inclosed picture, would be submerged. The shafts which extend from the pump to the motors are distinctly visible. The electrical equipment consists of four 300-hp. General Electric vertical type motors. These are supplied with 440-volt alternating, three-phase, sixty-cycle current. The switch board which controls the motors is located in the center of the pump house.

The pumps, which were made by the Price Manufacturing Company of San Francisco, are each rated



Conaway river pumping plant at Elkhorn

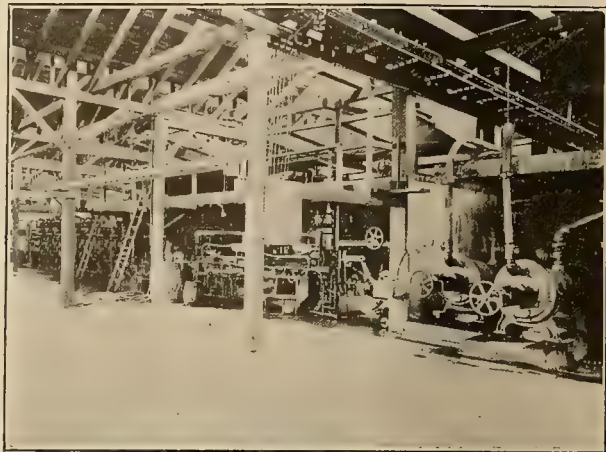
at 36,000 gallons per minute, and are designed to operate against a head of fourteen feet. The water is carried from this pumping plant across the Yolo basin into a reservoir from which it is diverted by gravity to the various lands on the Conaway Ranch. The service is fed from the Woodland substation of the Pacific Gas & Electric Company at 11,000 volts. The transformers reduce the voltage from that to 440, and it is carried from them to the switch house in which the meters are installed and from that point in conduit to the switch board that is in the main pumping plant.

This installation has been watched with interest by engineers engaged in irrigation work and after tests have been conducted it may prove to be the solution of certain problems that are met with in rivers with high banks or levees.

The Atlantic is bordered by countries inhabited by 325,000,000 people, the countries bordering the Pacific contain 630,000,000. The Pacific Coast is the gateway to this region.

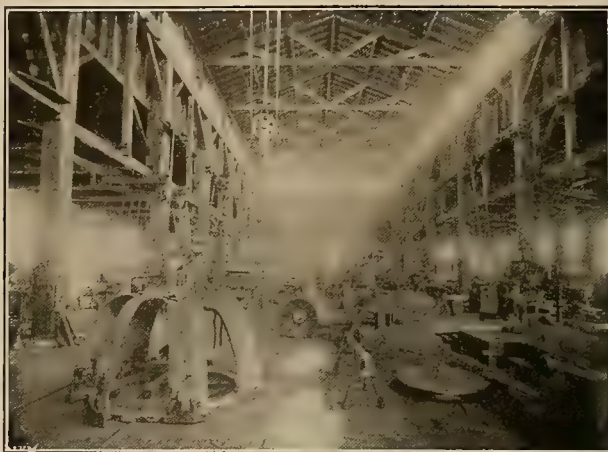
FORWARD WESTERN INDUSTRY!

Building the Industrial West



PAPER MAKING

Pulp machines in the California Tissue Mills at Vernon, California, where electric drive makes the factory an important consumer of power.



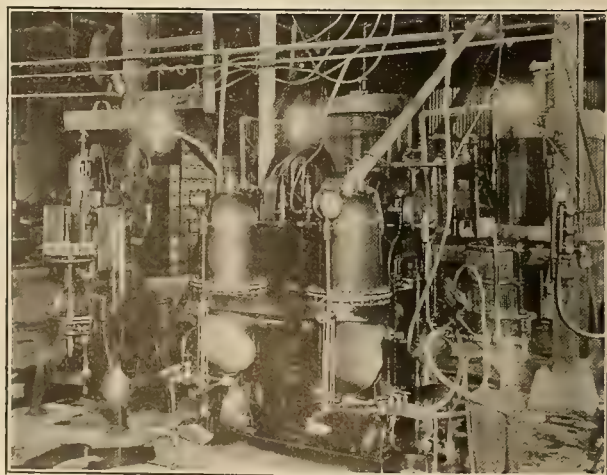
SHIPBUILDING

Electrically equipped machine shop of the Craig Shipbuilding Company, Long Beach, California. Electricity is being widely used in Western shipyards.



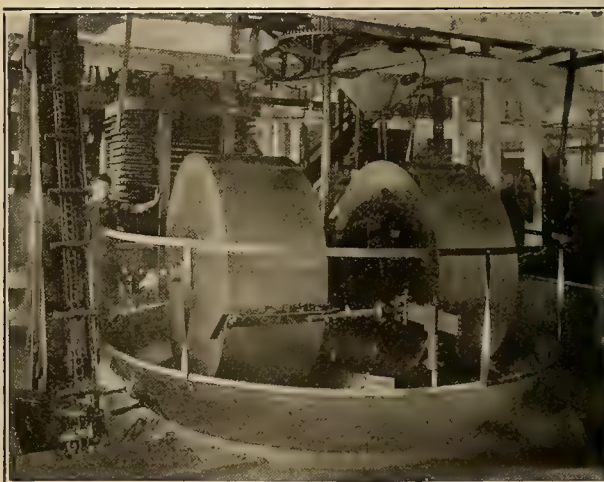
RUBBER GOODS

One of the largest users of electric power in the West is the new factory of the Goodyear Rubber Company, near Los Angeles, California, recently constructed at a cost of \$20,000,000.



CARBONIZING

Electrically driven carbonizer used in the manufacture of soft drinks at Fresno, California. One of the results of prohibition, as this was formerly used for other purposes.

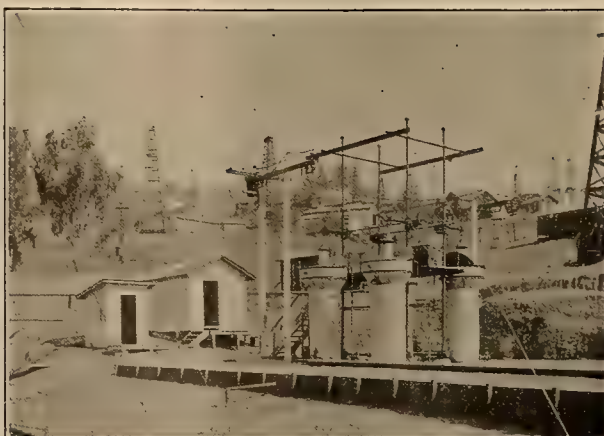


VEGETABLE OILS

Electrically driven machinery is being used by the Los Angeles Olive Growers' Association for the extraction of the olive oil from the fruit grown on their 1800 acres of olives.

**CEMENT**

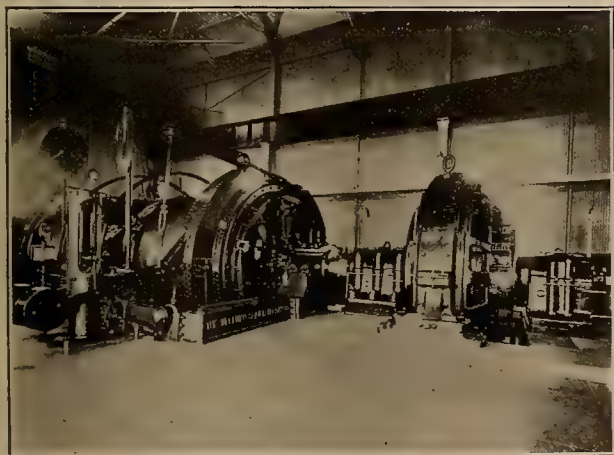
A battery of motors in the plant of the California Portland Cement Company at Colton, California. Construction work in the West makes a large demand for Portland cement.

**OIL FIELDS**

Not only in the production of oil is electricity used extensively, but also in its dehydration. This picture shows the dehydrating plant at La Brea, California.

**MILLING**

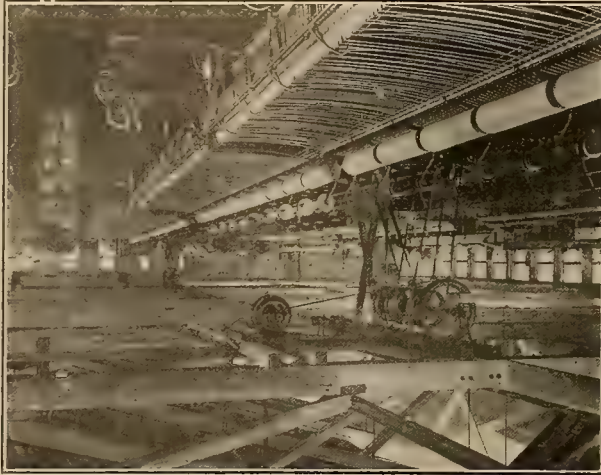
Twenty thousand horsepower in motors are installed in this Magna Mill of the Utah Copper Company at Garfield, Utah. A great deal of electricity is used in the metal-mining activities of this region.

**MINING**

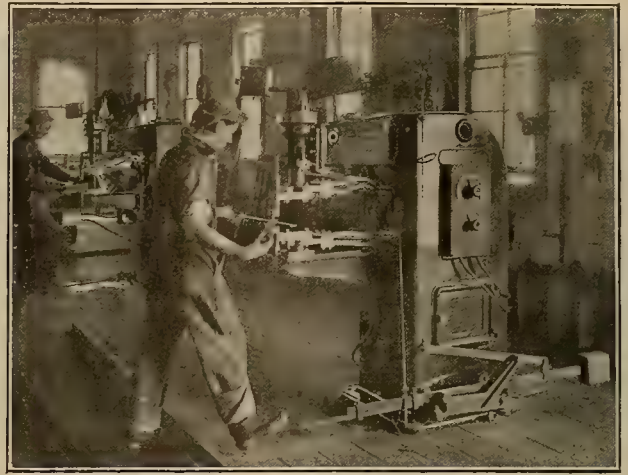
Large installation at the mine of the North Butte Mining Company, Butte, Montana. This 1850-hp. direct-connected motor is used in the hoist house.

**LUMBER**

Direct-connected 250-hp. motor driving a 72-in. by 12-in. edger at the Snoqualmie Falls Lumber Company's plant, Snoqualmie Falls, Washington.

**SPINNING**

Motor-driven spinning machines at the Portland Woollen Mills, Portland, Ore. Portland is now the second largest wool center in the United States.

**WELDING**

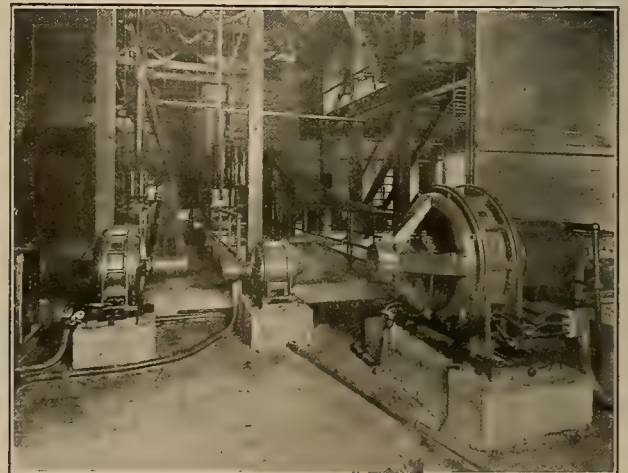
Spot welders in operation at the Columbia Wire and Iron Works, Portland, Oregon. There are a number of other similar installations in this city.

**TRACTION**

A 7-ton locomotive in the yards of the Weyerhaeuser Timber Company at Everett, Washington. Storage battery locomotives are being used in all kinds of industrial plants.

**FURNACES**

A two-thousand-pound electric brass furnace at the foundry of the Oregon Brass Works, Portland, Oregon. A manufacturer of electric steel in Portland is installing a new furnace of 1500-kw. capacity.

**REFRIGERATION**

Motors driving ammonia compressors, Crystal Ice & Cold Storage Company, Portland, Oregon. All refrigeration and ice-making in Portland is done electrically.

An Electrically Manufactured Food Product

(The industrial load in the West is becoming an important factor in the electrical development of the region, and consequently of its general prosperity. Following is a description of a model factory using electric drive in the manufacture of a food product and showing the possibilities for progressive industrials in localities where cheap electric power is available.—The Editor.)

Turning 400 bushels of wheat a day into a breakfast cereal would have been a herculean task for a regular army of factory workers in the age of miracles, but in the non-miraculous twentieth century a few dozen unhurried employes stand and watch electricity do it for them.

The green lawns and smokeless air around the Shredded Wheat factory at Oakland, California, are in keeping with the shining and smoothly-operating interior, and belie the common conception of an industrial plant as necessarily a manufacturer of soot and noise. Inside, the simple-looking processes through which the wheat passes in its transformation into the popular shredded wheat biscuit, are a series of illustrations of the debt which modern industry owes to electricity. From the moment the railroad cars deliver the wheat at the receiving platform of the factory—on a spur track from the electric system of the Oakland, Antioch & Eastern Railroad—until the biscuits are ready for shipment, the electric motor is in constant evidence.



The electrically equipped Shredded Wheat factory, Oakland, California.

Westinghouse make. In addition to its electrical equipment the factory has a special adjoining boiler house, where two B & W boilers generate steam for cooking and heating.

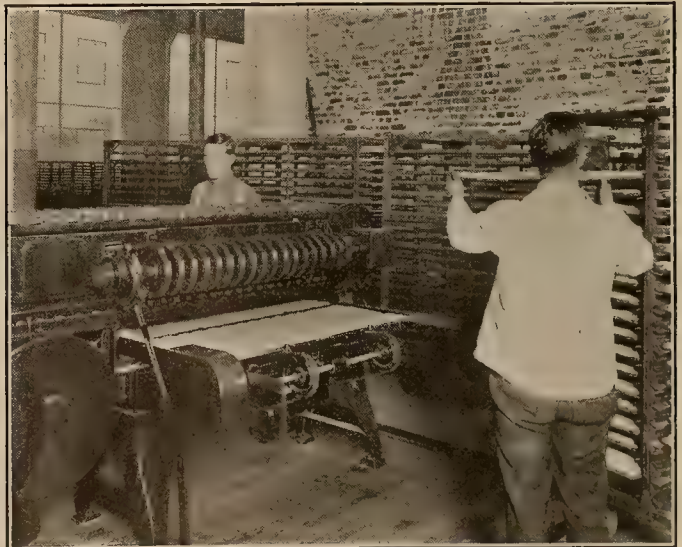
The sacks of wheat are not carried into the factory, but emptied direct from the car into a hopper, and conveyed from there by an electrically-driven screw conveyor to the weighing room. From the automatic scale the wheat is electrically elevated to the header room in the top story of the building, and delivered to another long screw conveyor which drops it into huge storage tanks. Two 10-hp. motors operate this second conveyor system.

Cleaning and Cooking

A motor-operated belt-and-bucket type of conveyor feeds the wheat from the storage tanks into the cleaning machines where it passes through five different processes. The various machines, driven by a 40-hp. motor, shake and sift it, separating all waste material such as dust, chaff, seeds and stones.



One of the motor-driven separating machines where the wheat is shaken free of dust and other foreign matter before being cooked.



The electrical cutting machine where the shredded wheat is cut into biscuits and dropped on trays in rows ready for the oven.

Power is supplied by the Pacific Gas & Electric Company at 4400 volts and stepped down by the factory's transformers to 110 volts. All the motors are

Industrial growth means not only an increased industrial load for the power company but also an increased home demand.

FORWARD WESTERN INDUSTRY!

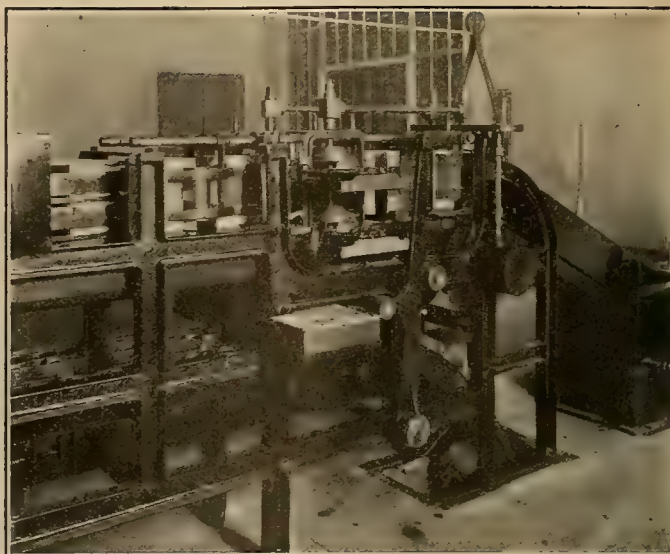


The giant oven in which Shredded Wheat biscuits are baked. The interior revolves in the manner of a Ferris wheel. The temperature of the oven is 500° F.

After being cleaned, the wheat is carried by bucket conveyor to another automatic scale where it is re-weighed and passed on to the cooker. Here it is steam cooked for 30 minutes, an electrically driven paddle inside the cooker keeping the grain constantly in motion. This process thoroughly cooks the starch grains and causes the wheat to swell up and become soft. The grain emerges from the cooker, however, perfectly whole, and passes by an electrically-driven ventilated conveyor (which allows it to dry thoroughly on the way) to large tanks where it is stored over night.

Shredding and Cooking

Another conveyor system delivers the cooked wheat to the shredder where it goes through a process which is the most interesting of all to watch. The grain, now in a soft state, is passed along on a belt from which it drops at intervals down small hoppers or funnels. Below each hopper is a pair of steel rollers, one smooth and one corrugated, and the soft wheat passing between them falls into a moving



Automatic sealing machine where the packed cartons of biscuits are sealed top and bottom. Notice the elevator at the right by which the cartons come up from the floor below.

trough below in the form of long shreds. As the trough moves along under the series of hoppers the light layers of shreds accumulate, and by the time the end of the line is reached the accumulation is of the required thickness for the biscuits.

The cutter at this end consists of series of small knives on a revolving belt, each one of which cuts a biscuit from the end of the moving line of shredded wheat. Air suction holds up the cut biscuits until fifteen have been cut, when the whole row is deposited simultaneously on a tray. The cutter goes on without interruption, and the tray moves out slightly to make room for the next row of fifteen. As the knives on the cutter pass along the top of the belt they are brushed by a stiff revolving brush and are free of shreds when they pass under for the next cut. This shredding and cutting machine is driven by a 50-hp. motor.

Baking

When one tray is full of biscuits it is removed by the attendant and loaded on to a kind of dumb waiter—tiers of racks on wheels. When this is full it is wheeled away to the ovens where the trays of biscuits are transferred for baking. Inside these gigantic ovens is a great wheel, similar to a Ferris wheel, which revolves, bearing the trays of biscuits through a temperature of 500° F. After 25 minutes the biscuits are baked to a crisp brown and the trays are drawn out and again placed on the trolley. This is then wheeled into a hot air chamber,—where a temperature of 210° F. thoroughly dries the biscuits without cooking them any more—out at the other end, and over to the packing tables.

Packing and Sealing

At the packing tables the trays of biscuits are loaded one at a time on to a wide slowly-moving belt. The girls seated at the tables take the biscuits as they pass and pack them in the familiar cartons, placing the full cartons on another moving belt above the trays. These pass along to a small elevator shaft through which they are raised automatically



Electrically equipped machine shop of the Shredded Wheat factory where all repair work, and so forth, is done.

to the sealing and packing room on the floor above. Here they pass through the electrically-operated sealing machine which pastes the flaps of the cartons, closes them and seals them with strips of gummed paper.

At the other end of the sealing machine the cartons are received by an attendant who packs them in large cases ready for shipment, 36 cartons to a case. The cases are then loaded on to a spiral elevator which delivers them outside the building on the same platform where the original wheat was unloaded from the railroad car. The output of the factory is about 1100 of these cases per day.

The most vivid impression left in the mind after watching the entire process is the miraculous ease with which the whole complex system operates, the electrically-driven machinery passing the product unerringly through one process after another with hardly any human labor other than supervision. The perfect cleanliness of the method electrical is also brought home very strongly as the ideal method for the manufacture of a food product. The Shredded Wheat factory with its modern equipment has become one of the show places of Oakland—so much so that a special guide is maintained to show visitors

through the building, and the car conductor calls "Shredded Wheat" at the car stop. The factory, which is comparatively new, is an example of the type of industrial development which is taking ad-



The rest room for women employees at the Shredded Wheat factory. In addition to this there are recreation grounds, locker rooms, shower baths, a hospital, and a dining room where employees are the guests of the company for lunch.

vantage of the availability of cheap power on the Pacific Coast, and building up the industrial load which is to mean more and more to the prosperity of the region west of the Rockies.

Large Capacity Navy Yard Crane

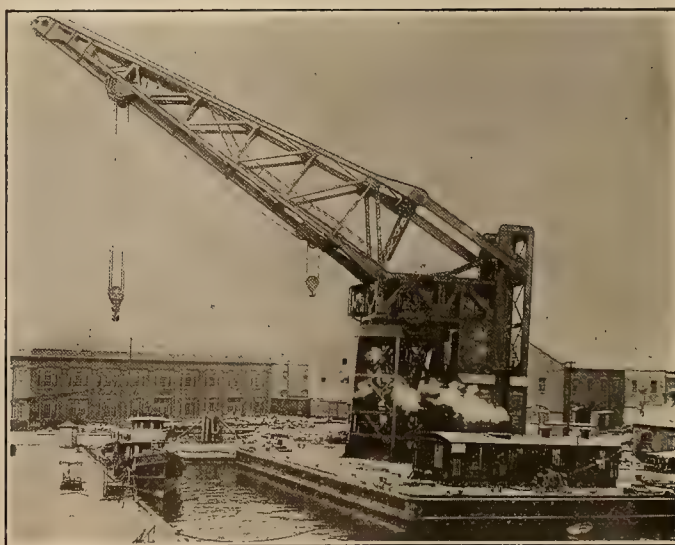
(Increased production is largely dependent upon the rapid and efficient handling of material, and the electrically operated crane described below has contributed in no small degree to the work of the large Western navy yard where it is installed.—The Editor.)

A 150-ton electrically operated pontoon crane, put in service last year in the Navy Yard at Mare Island, California, has several interesting features. The crane lifted and swung a 205-ton load of armor plate in the acceptance test. A complete power plant is contained in the hold, so that the crane can operate independent of shore connections, but it has no propelling machinery and a tug is required for moving it except as it can pull itself along the water front by means of shore or anchor lines to the motor-driven capstans. Its total floating weight is about 2600 tons.

During the year in which it has been in service at Mare Island it has been busy practically all the time, sometimes sixteen hours out of twenty-four. It first gained popularity with yard officials because it could handle the smaller boats that otherwise would have required the use of the drydocks, but the placing of boilers, guns, armor plates and other heavy equipment has been done so much more easily with this crane than was formerly possible, that it is now said to be one of the handiest pieces of equipment at the yard.

The steel pontoon which forms the support for the superstructure is 85 by 140 ft. in plan and 15 ft. deep. Full depth collision compartments entirely surround it and there are also longitudinal and transverse bulkheads in the interior. Compartments for the boiler plant and generating unit are in the after-end, and have an open hatchway covered by a deck house. One end of this deck house is enclosed and used as the crane office.

The superstructure is located on the longitudinal center line of the pontoon with its center 42 ft. from the forward end. A fixed tower 43 ft. high, which is secured to six bulkhead plates extending through the deck of the pontoon, surrounds the lower part of the rotating structure, called the pintle. The entire



The 150-ton electric crane at the Mare Island Navy Yard, California, has facilitated tremendously the handling of the construction and repair work

\$710,510,000 is to be spent in the development of the power resources west of the Rocky Mountains within the next nine years. The power companies will be ready for the industrial load.

FORWARD WESTERN INDUSTRY!

rotating element of the crane consists of three parts, the pintle section, the machinery section and the jib. All motions of the crane are controlled from the operator's cab which is located on the rotating structure.

The main hoist, designed for a capacity of 150 tons at a radius of 105 ft. (which gives a reach of 62½ ft. beyond the fender line), consists of two separate units, arranged to be connected when handling capacity load. Their hook blocks are suspended from a fixed position on the jib and operate at a rate of 4 ft. per minute from any position between 25 ft. below to 95 ft. above water level.

A hook block for handling loads under 25 tons is suspended on a trolley which travels along the under side of the jib. This hoist has a vertical range from 25 ft. below to 130 ft. above water level. It can handle a capacity load at a speed of 12 ft. per minute or a 5-ton load at 60 ft. per minute. The jib, carrying the maximum load, is luffed from its lowest position to the highest point in 15 minutes, and in the reverse direction in about 11 minutes. A complete rotation of 360 degrees under full load conditions requires between 4 and 5 minutes.

Each of the 75 ton main hoist blocks is operated by a winding drum connected by three cut spur gear reductions to a 40-hp. series wound motor. An electrically operated disk brake is attached to the motor pinion shaft, and so connected that it sets instantly when the current is cut off the motor. In addition to this, there is also a mechanically operated band brake for emergency use only, this brake being attached to the intermediate shaft. A master switch in the operator's cab operates the magnetic switch controller which regulates the hoisting mechanism. The magnetic controller is provided with a dynamic braking device to give positive and accurate control when lowering heavy loads.

The 25-ton auxiliary hoist block is operated by a hoisting unit located in the machinery section of the rotating structure directly above the main hoist units. The motors are of the same capacity, and control and automatic braking devices are similar to those of the main hoist. This block is suspended from a movable trolley which travels along the under side of the jib. The mechanism for this motion includes 40-hp. motors and control equipment similar, in the main, to the other two units.

Electric current for operating the motors and lights is supplied by a cross compound marine engine direct-connected to a 150-kw., 250-volt d.c. generator. The power leads from the main switchboard terminate in contact shoes attached to the fixed tower and engaging collector rings on the rotating structure. Steam for the engine generator set and for two steam-driven windlasses is supplied at 150-lb. pressure by a 200-hp. Scotch marine boiler.

Four capstans driven by 15-hp. motors are located at the corners of the pontoon. Internal gearing on these capstans is so arranged that the change from high to low speed is effected by simply reversing the motor.

AN OIL-ELECTRIC PROPELLED YACHT

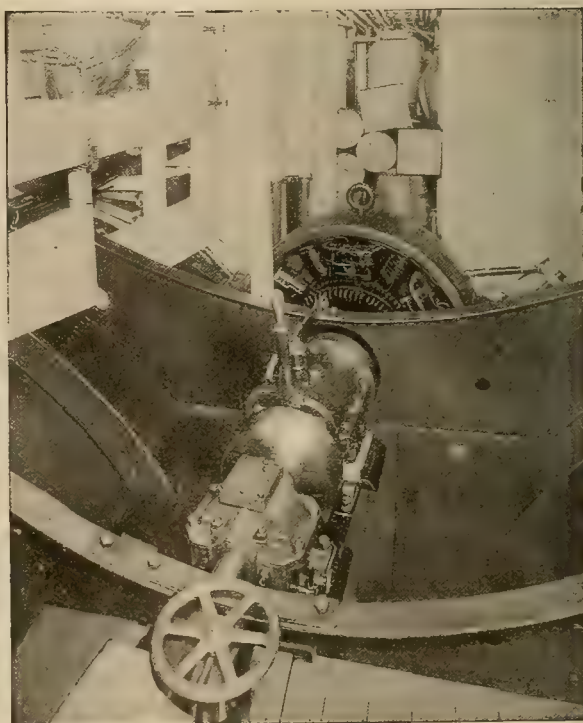
The yacht Elfay—the first in the world to be driven by the Diesel electric system of propulsion—left New London in the early part of this year for southern ports.

This most interesting little vessel, which was originally the "Katoura," was built in 1914. She is essentially a sailing schooner, 152 ft. over all, 30-ft. beam and 313 tons. Her propelling equipment consists of a 60-cylinder 115-hp. model 54 Winton Diesel oil engine direct-connected to a 75-kw. Westinghouse generator. This supplies power to a 90-hp. Westinghouse motor of 360 r.p.m., which is directly connected to the propeller.

The control of this motor is centered in a single handle located on the deck. By turning this handle in one direction, the propeller motor is started from rest and brought through several steps up to full speed ahead. By turning the control handle in the reverse direction, the motor is reversed in a similar manner, and the change from full speed ahead to full speed astern can be effected in 5 seconds. There are no signals to the engine room, and the officer in charge has full control of the propelling equipment. A set of meters gives the navigator full information as to the performance of the machinery.

This simplicity of control is due to the fact that the controller handles neither the main engine nor the main motor current, but only the small generator-field current. The engine itself is operated from the engine room, but is merely kept going at normal speed in one direction only.

All of the auxiliary equipment of the Elfay is electrically operated, including the winches, pumps, fans, blowers, ice machines, and so forth. She is also electrically heated.



The engine room of the Elfay, the first yacht to be driven by the Diesel electric system of propulsion. The motor shown is centered in a single handle located on the deck.



This old San Joaquin Plant No. 1 was placed in operation in 1896 and was the subject of much comment not only on the boldness of the long transmission line but on the daring of the development itself, due to the great head under which the wheels operated.



The penstock control system consisting of gates, air vent and air pressure box at the head of the pipe line above old "San Joaquin" Power House No. 1 has been abandoned since 1911 when the new No. 1 plant was installed.

Reminiscences of Power Development on the San Joaquin

BY A. G. WISHON

(The early adventures of a power company in the pioneer days of Western hydroelectric development provide a story of intense human interest as well as a historical record of no little significance. The romantic history of a company which now serves almost the entire San Joaquin Valley is told here by its general manager. The second part of this story will appear in the next issue.—The Editor.)

In 1895 Eastwood and Seymour built the first power house of this system on the San Joaquin River, with a capacity of 1450 kw. and a transmission line thirty-five miles long into Fresno, which at that time was the longest transmission line in existence. The static head of the plant was 1410 ft.—the highest operating head then in America. The line had two circuits carrying 11,000 volts on one pole line of sawed, square redwood, 35-ft. lengths and spaced 125 ft.

A Dramatic Beginning

All troubles incidental to new things happened to these pioneers. One of the interesting incidents that occurred was in the installation of the machinery in the power house, by a German electrician sent by the General Electric Company. At that time it was thought that a quick closing valve was necessary, presumably that the plant might be shut down quickly in event of a dead short, as only hand governing apparatus was then provided. He forgot to screw on the nozzle tip, and when he opened the gates it flooded the wheel housing and power house floor. He then touched off the automatic valve, rupturing the pipe about 500 feet above the power house. This permitted a quick escape of the water and sucked shut about 2,000 feet of the upper end of the riveted pipe line, so that it was many moons before the power house was ready to operate. In the hurry to install more pipe, this repair job was laid with lead joints. The organization was familiar with the laying of pipe lines with lead joints and knew little of the more modern method of riveting. In the confusion that followed, this German workman left the plant about an hour before nightfall—even leaving his hat—and walked some sixty miles to Madera, where he took the train for San Francisco, drew out of the bank his balance of about \$2,000 that he had placed there on

his arrival from Germany, and the next time the General Electric Company heard from him he was back in Germany, where he probably thought he would be safe from being sued for damages. He was taking no chances on losing his money.

In the Camp of the Enemy

These people who built the first San Joaquin plant owned and operated the Fresno City Water Works, and, of course, because of their coming into the town with a new lighting scheme were at once considered the arch-enemies of the people owning the Fresno Gas Works, that up to that time had furnished gas for lighting Fresno; and as it was before the days of cooking with gas it looked as though they were going to lose the major part of their business. The late Fulton G. Berry was the moving spirit in the gas works and was also proprietor of the Grand Central Hotel, and as such, was looked upon by the whole community as a plutocrat and corporation magnate. In order to head off the power company, which they considered their deadly enemy, that was taking away all the lighting business of this coal gas works, the fertile brain of our late friend Berry conceived the idea of buying riparian land on the South Fork Canyon above the intake of the power company and diverting all the water and using it to irrigate the chaparral on top of the flat ridge, and, with the aid of two men he kept it from flowing back to the stream. This was done at the low season of the stream flow, when it took all the water in the stream, and while it fulfilled no useful purpose, it did accomplish its deadly work

21% of the nation's copper is located west of the Rocky Mountains. This is but a sample of the raw mineral wealth at hand.

FORWARD WESTERN INDUSTRY!

and was the real cause of the new power plant going into the hands of a receiver. Here is where the present owners found it, and here the story of San Joaquin's progress begins.

The receiver, however, during his term as such, issued certificates and financed the building of a small reservoir that held 2,650 acre-feet, the earthen



No. 1 Power House of the old San Joaquin was equipped with four G. E. 3-phase, 700-volt, 360-kw. revolving type generators of the 1896 model. This plant was regarded as the most efficient of its time. The water wheels were outside the building, the drive shaft running through the wall housing the generators. The water wheels were equipped with Dobel buckets.

restraining dam for which was built adjacent to the present dam of the Crane Valley reservoir. The reservoir so created is a part of what is now the 50,000 acre-foot reservoir of the power company.

Getting Things Started

When the new management arrived on the job, early in 1903, the pine lumber flumes in the conduit line, which constituted about one-seventh of the whole distance, were so rotten that the lumber would hardly hold a nail. There were no lumber mills running in that section at that time, so the repair of the flumes was made with wire yokes. The pipe line was not covered for three-quarters of its length and, therefore, the expansion and contraction necessitated shutting down once or twice every week for a number of hours, in order to tighten up the lead joints that would crystallize on account of vibration; but with the aid of a wheelbarrow crew, this pipe line was soon covered, the lead joints being left exposed so that they might be tightened up from time to time. The covering of the pipe line, with the exception of the joints, did away with nine-tenths of the shut-downs. Bulkheads were then erected in the spillway at the dam, increasing the stored water in the reservoir to 4300 acre-feet.

As the load came on gradually, the voltage was stepped up to 19,200, with the possibility of a future step to 33,000, though at that time so radical a departure was looked upon with considerable suspicion, notwithstanding that we incurred an expense of re-insulating the line with pin type insulators, sufficient for that purpose.

The Battle of the Meters

A line had been extended to Hanford and service was rendered for lighting, nearly exclusively on a flat rate, with the help of about one thousand Lacy controllers, the scheme of which was to kick out if they put on more lights than they contracted for. At that time, probably not more than 100 meters were operating in Fresno and none in Hanford. The process of changing from flat rates to meters necessitated the manager moving his desk up near the front counter, so as to lend assistance to the victim on the front counter, whose duty was to put over enough diplomatic talk to convince the consumer that it would not "hurt much," if at all, to make the change; but we were cautious enough to pick out what we considered the least influential people first, in bunches of one hundred to a hundred and fifty, and get them connected up before we would select with great care and consideration another lot. Many were the long-winded discussions, but we finally got it down to the last hundred lot, which was supposed to be the most influential hundred in Fresno, and great care and diplomacy was exercised in convincing these people. The final argument used was that flat rates had put the old company in the hands of a receiver, and all in the world that we were trying to do was simply to keep out of the same predicament.

To save the cost in re-insulation of the line from the power house to Fresno, we conceived the idea of cutting out every other pole. Before deciding upon so radical a departure from the standard practices of transmission line construction, we called in one of the leading electrical engineers of the Coast, who concluded that a 250-ft. span was unthinkable and unsafe. He would consent to 200-ft. spans but not a foot longer, and therefore this radical departure was abandoned. From one standpoint, it was cheaper to buy and erect the additional number of insulators than it would be to dig holes and reset the poles, and the controlling question was—we had but one pole line and could not think of abandoning it long enough to rebuild.

The line to Hanford had been built to the same type, with 150-ft. spans, and Hanford was on a flat rate, paying \$400 a month. When our old friend, the late H. G. Lacy, was notified that we expected to install a meter it caused him great apprehension and almost resulted in a riot, and, when the meter finally got into action and his first bill was rendered for \$1100.00, the management would be at Crane Valley when Mr. Lacy came to Fresno and would not return until Mr. Lacy got back to Hanford. But finally he got used to it, and soon it became a matter of course. Our relations were ever after very pleasant.

The "Old French Ditch"

In about 1875 the Quartz Mountain Mining Company built a ditch from the present site of Crane Valley Dam, on the location now occupied by the No. 3 Ditch, and expected to take the water around to Quartz Mountain for the purpose of operating a gold mill—not, of course, to furnish power but to furnish water for the plates. This mining company built a beautiful residence on top of Quartz Mountain

that had a view of all the country for a hundred miles, with verandas all around it, glassed in and made comfortable from the winds and weather of that lonely peak. They had eight or ten bedrooms, a good cellar well filled with plenty to drink, and patiently waited for the completion of the ditch, when the opening of that "hole in the ground" would be an epoch in the history of what was then Fresno, but now Madera county. The ditch was completed and then the trouble began. They started a small sawmill to cut the lumber for the flumes on their ditch line and were so indiscreet as to cut timber off government land. They were arrested for so doing by a Deputy United States Marshal and were taken before the district court in San Francisco, but were released upon \$10,000 cash bail. These Frenchmen probably pined for the sights of Paris, for they forfeited their bail bond, and have never been heard of since. But they left the "old French ditch" there, and in 1905 the present management opened it up and used part of it in the building of the No. 3 plant, which was finished in 1906.

ELECTRIC HAMMERHEAD CRANES

(The industrial application of electricity is ever becoming a more important factor in large scale construction. The following tells of a recently developed electric crane which did much to make possible the increased war output of Western shipyards. —The Editor.)

The great demand for machinery of all kinds brought about by the Great War compelled Pacific Coast industries to look to local manufacturers for machines of various sorts. Important among the labor saving devices used in large numbers, especially by shipbuilders and lumber mills, are electric cranes.

To partly fulfill the needs of these industries, the Northwest Engineering Corporation of Portland developed a line of electric cranes commonly called "hammerhead cranes." These cranes have a track travel speed of 300 to 400 feet per minute, a hoisting speed of 60 feet per minute with 5-ton load on two parts of line, and 30 feet per minute with 10-ton load on four parts of line. The trolley with load may be traveled along the boom at 100 feet per minute and the entire upper structure can be revolved through a complete circle in about one minute.

The maximum radius of the hook is 80 feet and these cranes have been designed and built for two capacities, 5 tons and 3 tons, at this radius. Corresponding maximum capacities at 40 feet radius are 10 tons and 5 tons, respectively.

All of the functions of this type of crane are performed by a single 50-hp. motor through gears and clutches. The entire mechanism as shown in the detail view of the machinery was designed especially for these cranes, which accounts for the extreme compactness and ready accessibility. The entire mechanism of each crane was assembled in the shop so as to insure speedy and proper erection.

Most of the cranes built have been for 440 volts, 3-phase, 60-cycle current, although 220 volts direct

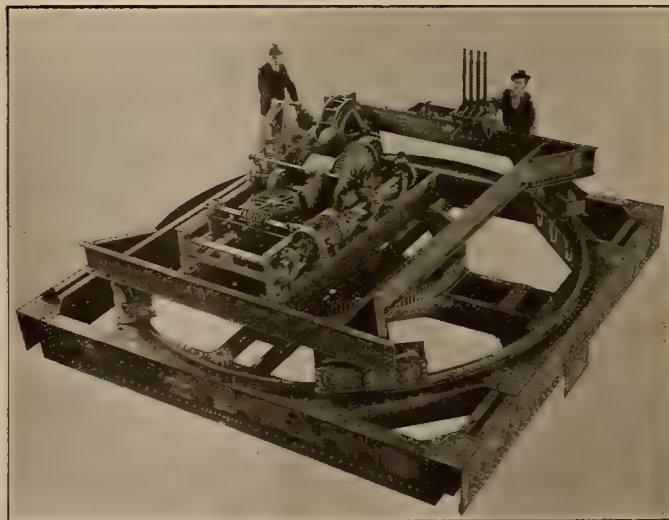
current was used on several. In all cases the current is supplied to the crane by means of trolley wires enclosed in a conduit below the level of the rail. An extremely rugged box shaped collector arm fitted with trolley wheels or sliding shoes is used to make



The above crane is used by a large Oakland shipyard for unloading and storing plates in racks. The crane travels on a wide gauge track, either 16 or 20-ft. gauge. The lower part, or portal pier, upon which the upper structure including the operating machinery and house revolves, is designed to allow standard gauge cars to pass through.

contact with the trolley wires. The box-shaped arm also serves as a conduit for the wires leading up to the motor.

Heavy split brass collector rings are used with controller type fingers to carry the current from the lower to the upper rotating part of the crane. These



Assembled view of machinery showing motor, hoist, rotating frame and portal deck of the electric hammer-head crane.

rings are supported on insulating blocks surrounding the central king pin castings of the crane.

An automatic oil switch with no voltage release is used as a part of alternating current equipments, and a carbon break circuit breaker with no voltage release is used with direct current cranes. All wiring is placed in iron conduit with approved outlets.

25% of the orchard fruit of the nation is grown in the West, and 17% of the wheat, with similar records for other food products. The raw materials are here.

FORWARD WESTERN INDUSTRY!

More Power for Western Development



The new Caribou plant of the Great Western Power Company will have an initial installed capacity of 59,000 hp. and an ultimate capacity of 176,000 hp. The construction involves diverting water from Lake Almanor through 2 miles of rock tunnel to Butt Creek, where a dam will store 600 acre-feet of water, and returning it by other tunnels to the Feather River about 10 miles below Lake Almanor. The view above shows the Feather River at the location of the power house. Other views of the same project are shown opposite. The plant is expected to be in operation by March 1, 1921.



Captain H. F. Jackson, general manager of the Great Western Power Company, is standing at the right, while S. L. Shuffleton, western manager of the Stone and Webster Company, in charge of building the Caribou plant, tells Gaskell S. Jacobs, engineer with the California Railroad Commission, of the progress of the work. At Mr. Jacobs' left is R. C. Starr, chief construction engineer of the San Joaquin Light & Power Corporation, who has just completed the company's Kerckhoff installation.



The spillway of Lake Almanor of the Great Western Power Company. Note the great bodies of water ten miles in length above this spillway, all being conserved for power purposes and the driving of industries hundreds of miles away. This lake with its 300,000 acre-feet of storage is at present the largest artificial reservoir in California. Its ultimate capacity of 1,250,000 acre-feet will exceed that impounded by the Assouan Dam of Egypt, thus far the greatest in the world.



James Byers Black, general sales manager of the Great Western Power Company, has that self-satisfied smile as he notes the sign above, "No Passengers Allowed to Ride on This Incline," for he knows whether they ride or not everyone will be carried away by the scenery, and by the vastness of the enterprise which he is showing them.



The two oldest inhabitants on the job. J. M. Howells, chief consulting engineer of the Great Western Power Company, who was the original discoverer of the great series of projects of the Great Western Power Company, including Lake Almanor, and with him, to his left, is C. B. Goon, an old-time employee of the same company.



H. A. Mangold, on the left, superintendent of power house construction of the Great Western Power Company, and R. C. Starr, chief construction engineer of the San Joaquin Light & Power Corporation, felicitate each other on the work in which they are engaged—the installation of great power plants in the West.



O. W. Peterson, chief field engineer for the Shattuck Construction Company, in charge of building the upper tunnels for the Great Western Power Company's Caribou plant. Mr. Peterson has the contented smile of one who knows that the difficult work of tunnel building, hampered by underground waters, is being efficiently handled.



Looking downstream from the Big Meadows Dam of the Great Western Power Company from Lake Almanor. Note the water that is being discharged from this giant reservoir in the heat of summer to supply the great Las Plumas plant many miles below. Next year this flow will be entirely lacking, as the water will be taken from the lake through tunnels down through the Caribou plant without passing into the native stream at this point.

The Use of Seasonal Advertising

While a large number of electrical contractor-dealers take advantage of certain seasons of the year to use seasonal advertising such as Easter, June, spring housecleaning and so on, there is no doubt that they overlook a great number of chances to tie in with local or community happenings at other seasons. One of the large jobbers on the Pacific Coast took advantage of a series of circumstances to put on a seasonal campaign that has attracted wide attention.

The anniversary of the admission of the state of California into the Union, September 9th, is known in that state as Admission Day and is celebrated throughout the state by various civic and county bodies and especially by the Native Sons of the Golden West, a lodge composed of men born in the state of California. The first flag of California when it declared its independence from Mexico carried on it a bear, and as a consequence the bear has played quite an important part in the history and legends of California. Therefore, in determining to launch a campaign for the sale of Edison Mazda lamps which are made in Oakland, California, the manager of the Sales Promotion Bureau of this firm decided to start the campaign in the first week of September and in some way tie in the bear, Native Sons and the lamp in some striking manner.

The result was the "California Native Sun Campaign" and the window cards shown along the border of this article were sent out to the agents selling these lamps with a diagram showing how to set them up to best advantage. The little bears seem to have struck the right keynote as the dealers who have used these bears in advertising have had a big increase in business and have aroused a great deal of interest on the part of the general public. This is indicated by the many requests by men and women for reproductions of the little bears in the shape of souvenirs the dealers could give away.

This display ties in with all the essentials of an effective display as stated by H. W. Angus in his articles on "Advertising," now appearing in the Journal of Electricity. He states, "The general weakness of contractor-dealers' window displays is lack of unity, non-use of color, lack of display cards and no seasonal tie-in." The whole idea of the "Native Sun Campaign" is for better lighting with the proper lamp suggested for each use. The suggested arrangement of the window is to use the display cards, which are in orange, black and white, and tie in with a local affair as explained above.

There should be more of this seasonal advertising which is local in character. In cases where the jobber covers such a wide territory that his advertising suggestions do not apply to local conditions the contractor-dealer should exercise some ingenuity and bear in mind that, while the windows in his store were originally intended simply to let in light, they can be put to work and made to earn enough to pay for the rent of his store.

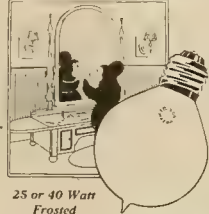
A NATIVE 'SUN' for EVERY NEED



For the
Dining Room
B or C types



A NATIVE 'SUN' for EVERY NEED



25 or 40 Watt
Frosted

For Sidelight lights



A NATIVE 'SUN' for EVERY NEED



100 Watt
Boxed Frosted

For the Kitchen



A NATIVE 'SUN' for EVERY NEED



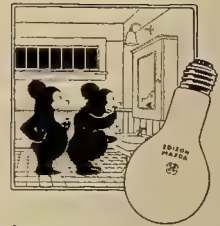
50 Watt Clear

For the Garage



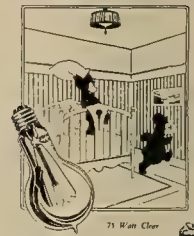
EDISON MAZDA LAMPS

A NATIVE 'SUN' for EVERY NEED



For the Bathroom
White Mazda

A NATIVE 'SUN' for EVERY NEED



75 Watt Clear
Properly Shaded

For the Bedroom



A NATIVE 'SUN' for EVERY NEED



White Mazda

For the Living Room



A NATIVE 'SUN' for EVERY NEED



For the Porch

10 Watt Clear



EDISON MAZDA LAMPS

A man determines your character by looking into your eyes. Remember, your windows are the eyes of your store and its character is judged by your window displays.

Seasonal advertising must also tie in with some national campaign to secure the best results. These tie in with the campaign for better lighting now being carried on.

Advertising

BY HOWARD ANGUS

(Newspaper advertising is not the whole story of advertising. Among important supplementary work is direct advertising, the various forms of which are here taken up by the Secretary of the California Cooperative Campaign, in the fourth of his series of articles on the subject.—The Editor.)

Direct advertising embraces that literature distributed from the store by hand and through the mail. To use only newspaper advertising without this medium places the advertiser in much the same position as a fighter who goes into a scrap with one

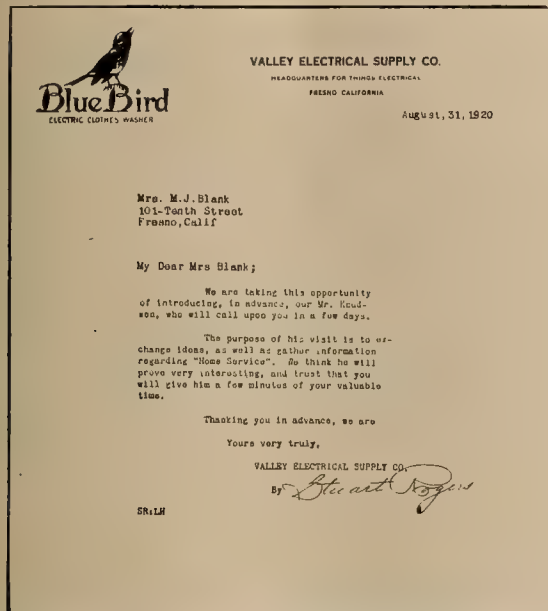
advertising racks placed on the counter, on show cases, on the walls and in cozy corners. In these racks various booklets furnished by the jobbers and manufacturers can be displayed and the customers allowed to help themselves.

This means of distribution is effective for the simple reason that people taking literature are interested, otherwise they would not take it. The reading is guaranteed. Another effective distribution from the store can be secured by wrapping literature in every package sent out. This, preferably, should be literature on other appliances than those sold to the customer. Having bought one or several appliances the customer should be interested in others. This distribution is effective for the simple reason that people usually read or at least glance at literature found in packages. A rack can be conveniently placed under the wrapping counter for use by the sales people. Another means that has been found satisfactory is to frame manufacturers' advertising posters on the walls. These can be framed with wall molding without any glass at little expense. Your walls then talk, and as most of these posters show somebody using the appliance, sell the service that is rendered by the article. Incidentally your bare walls are decorated, adding to the attractiveness of the store.

Probably as effective a means as any of distributing literature by hand is to have your solicitors leave literature with the people on whom they call. Some dealers use boys to place literature in automobiles parked on business streets of the town. If pamphlets are laid on the seats of the automobile, people have to pick them up to get rid of them and they instinctively glance at them. Others use men or boys to go from house to house leaving their literature. Usually boys can be employed for this after school hours or during their vacation at a nominal cost.

Distribution By Mail

For mail distribution you must have a mailing list. This mailing list, to be of any value to you, must be kept up to date. This mailing list should be divided at least into two parts, one consisting of customers and the other of prospects. The names of your customers can be obtained by your salesmen and from your billing list. All customers are live prospects for every appliance they have not purchased, and after they have purchased every appliance you have to sell, they are still prospects for replacements. Contractor-dealers are prone to neglect their customers, forgetting that they are the livest



A letter sent out by an up-to-date electrical dealer to prospects for electric clothes washers. A brief, neat letter of this type arriving through the mail is sure to command attention.

hand tied behind his back. The two go together and are closely allied.

Direct Advertising

This phase of advertising can be divided as to customers into three classes—to the public generally, to prospects, and to old customers. Distribution to the public generally is by hand, such as placing it in automobiles or taking it from door to door and through large mailing lists secured from the telephone directory, newspapers and the like. Distribution to prospects is distribution to people you have found interested in appliances or wiring. Distribution to old customers would be distribution to those who have purchased something from your store.

Practically all this literature, with the possible exception of letters, can be secured from electrical supply jobbers and manufacturers without any cost to you—a tremendous financial advantage and something which should be deeply appreciated. To leave this literature lying in your basement is the height of extravagance. It is of importance to you and the electrical industry only if people read it; otherwise a great deal of money has been wasted.

Distributing Literature From the Store

Literature can be distributed from a store satisfactorily by several methods. One is by means of

The great reserves of the Orient are shipped first to the Pacific Coast and add to its store of raw materials.

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of prospects, and spend all their efforts on people who have never been into their store. Customers should receive literature at least four times a year, which in general divides the year into the four seasons of spring, summer, fall and winter, each having its particular appliances suitable to the time. You can in this manner keep very close to your customers, and have them always familiar with your merchandise. In addition to your literature they should receive such articles as a calendar and any advertising notebooks distributed. There are two clothing stores from whom I receive advertising literature in the spring and in the fall. From one of these I receive a pocket notebook. My vanity is pleased with the attention shown, and as a natural result I purchase my wearing apparel from them. What these clothing stores are accomplishing with me and others like me, you can accomplish. Your customers should receive all notices of sales. You should think of them when you have a bargain as well as something that is difficult to move. Some will come to buy, probably most of them will not. But they will be pleased to know that you are thinking of their interests and that will result in the purchase of more appliances.

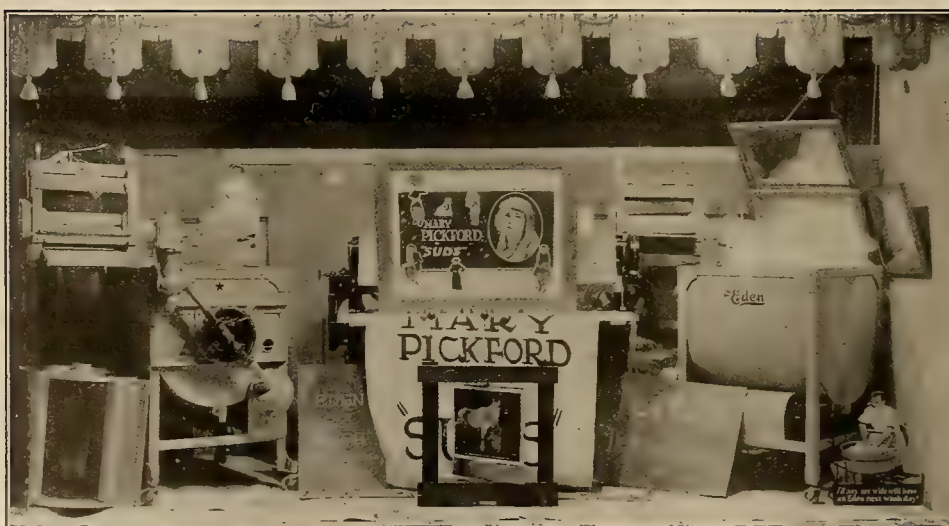
Compiling a List of Prospects

Your prospect list can be gathered by having salesmen take the names of those who make inquiries in your store for articles but do not purchase, from names turned in by your solicitors, from building permits and by exchange with some other merchants such as a furniture store. A dealer-only can secure an excellent list of prospects from a

contractor-only. The contractor-only can secure excellent prospects on wiring from a dealer-only. There is a possibility for a fair and mutually advantageous exchange. If your store is run according to departments such as contracting, large appliances, lamps, motors, any customer who purchases an article from one of these can be immediately considered a prospect for each of the other departments, and his name and address listed as such. Not enough contractor-dealers tie together their contracting and dealing departments. You will wire a home and then never bother to follow it up with selling efforts on appliances and thereby overlook one of the finest opportunities to increase your business. All of these prospects should receive literature and letters, explaining the service of electricity, its economy, convenience, and labor-saving features with an appeal to women's pride. Your letters are worthy of your most careful attention and should be brief and to the point. Remember, people will read a sentence when they will not a paragraph, a paragraph when they will not a page, and practically nobody will read a two-page letter. Once a prospect has purchased an article in any department, he should be transferred from the prospect to the customer list.

Your letter heads are an advertising medium. If they are so arranged that they catch the eye, awaken interest and state a short, brief, cardinal fact about your business—they will do much to spread the story of your store. People will read a letter head who will never glance at the body of the letter before consigning it to the waste paper basket.

Featuring Suds



Even the movies helped a certain dealer of Southern California to put over his washing machine campaign. Nothing attracts more attention in Santa Barbara than the name or picture of a Universal City queen and so Nelson & Smith, electrical dealers of that city, made capital of the fact that

they and Mary Pickford happened to be featuring "Suds" at the same time. Not only did the above window attract attention but an Eden machine especially arranged so as to generate an amazing amount of glistening "Suds," helped to draw crowds to the door of the theatre which was featuring that particular substance.

Hydraulic Equipment of Granby Mine

BY CHAS. H. TALLANT

(The development of power to serve special needs has some interesting examples in connection with the mining industry. The following account by a member of the Pelton Water Wheel Company describes the special features of an interesting installation in the Northwest.—The Editor.)

Several notable examples of extensive water-power utilization by large mining companies are found on the Pacific Coast, each one having decidedly interesting features. One of these is the installation

house, situated so that the tail water discharge from the various turbine units flow directly into the waters of Granby Bay.

Details of Installation

The power house proper is 50 ft. wide and 180 ft. long. It contains five hydraulic turbine-driven air machines for supplying air at various volumes and pressures for the operation of the mine and smelter, and two hydraulic turbine-driven generators, for supplying energy for the operation of the electric locomotive haulage system and the various electrical equipment used in the smelter operations.

As the diameters of the various turbine units in the power house vary from 40 inches to 23 feet, and the operating conditions made it advisable to maintain the floor of the power house upon continuous level, the elevations of the nozzles which supply water to the various turbines vary to a considerable extent. However, the average effective head, friction loss in the pipe line deducted, under which all the equipments at the power house operate, is 375 feet.

As is the case in practically all the streams in the northern part of British Columbia, the water flow of Falls Creek is quite variable throughout the year, depending largely upon the temperature conditions. This variation in stream flow has been compensated for, as far as possible, by the provision of water storage above the pipe line intake and dam. In order



View of buildings at the Granby works. The power plant is lower right, and the smelter at the left.

of the Granby Consolidated Mining, Smelting and Power Company, Anyox, British Columbia, in which hydraulic power, developed by Pelton turbines, is used exclusively as the primary power.

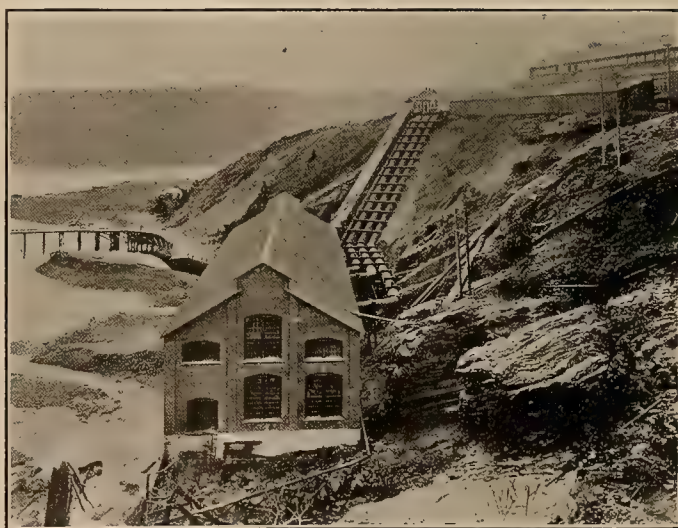
The hydraulic development of the Granby plant was made for the purpose of providing power for the operation of a pyritic copper smelting plant, with a capacity for the reduction of 2,000 tons of copper ore per 24-hour day.

Water Source

The power development utilizes the water of Falls Creek, a stream of considerable magnitude flowing generally in an easterly direction from the point of water intake and emptying into what was formerly known as Goose Bay—now Granby Bay. The stream drains a considerable mountainous, snow-capped area which, with the available water storage capacity, can be depended upon for a continuous flow of approximately 180 cu. ft. per second.

The point of water diversion was placed at a sharp bend in the creek, where the natural topography offers an exceptional opportunity for the creation of a large water storage basin as well as particularly favorable spillway conditions, by the installation of a comparatively simple and inexpensive rock-filled, timber crib dam.

The water is diverted through a continuous wood stave pipe line, 6ft. in diameter and some 6000 ft. in length, laid on a good average grade and closely following the hillside contour to a point directly above the smelter proper. From here riveted sheet steel pipe is used for an abrupt drop to the power



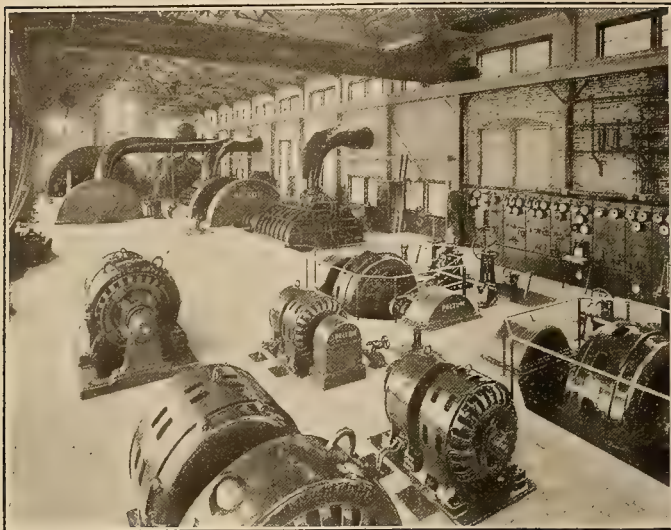
Exterior of the Granby power house showing the forked water line at the right and the air pressure lines in the center.

to limit the quantity of water used by the various turbine equipments to exactly that needed for the development of power at any particular time, the various equipments are provided with auxiliary relief

Shipping raw materials to the East and returning the finished product means two freight charges. Freight rates are high.

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water economizing nozzles. By means of these nozzles automatic governor control of the exact water supply to the various units is provided and all water not actually required for the development of useful



Interior view of the Granby power house, showing the various hydraulic turbine-driven machines. Note the main units set below the floor level.

work at the power house is conserved within its storage reservoir at the head of the pipe line.

The main blast furnace air supply for the smelter is provided by three Connersville positive blowers, one of which is a spare. Each of these blowers has a maximum delivery capacity of 40,000 cu. ft. of free air per minute against a pressure of 32 ounces, when operating at a speed of 115 r.p.m. These blowers are operated by direct-connected Pelton impulse turbines 14 feet in diameter, producing a normal output of 625 hp. and capable of a maximum capacity of 775 hp.

The air required for blowing the Bessemer converters used in the refining of the copper matte at the smelter is provided by means of a Nordberg variable capacity, 2-stage, hydraulic turbine-driven blowing engine, with a delivery capacity of 12,000 cu. ft. of free air against a maximum pressure of 18 lbs. per sq. inch, when operating at a speed of 75 r.p.m. This blowing engine has an impulse turbine about 23 ft. in diameter directly mounted upon its crank shaft. The construction of the turbine unit was accurately carried out so that the turbine runner provides the requisite energy storage or flywheel effect to insure the smooth operation of the blowing engine, as well as the power for the entire equipment. The blowing engine is the reciprocating type.

The great need for simple flywheel effect in a machine of this kind will perhaps be better appreciated when it is known that under the smelter operating conditions, the turbine unit, with a maximum capacity of 1400 hp., is subject to an abrupt change in output from no load to full load and this may occur from 10 to 12 times every hour.

The compressor which supplies the necessary air under pressure for the operation of drills and other compressed air tools at the mine and elsewhere on the property, is of the Nordberg two-stage reciprocating type and is capable of compressing about

4000 cubic feet of free air per minute to a pressure of 100 lbs. per square inch when operating at a normal speed of 84 r.p.m.

Power House Operation

The power house end of the plant contains two double overhung impulse turbine units, each direct connected to a 938-kva., 400 r.p.m., alternating current type Westinghouse generator. These turbine units develop a normal output of 1100 hp., while having a maximum capacity of 1400 hp.

The excitation of the generators during operation is accomplished by motor-generator sets, receiving energy from the main generators. It is necessary, however, to provide excitation current when starting the plant and this is taken care of by a small water motor direct-connected to the shaft of the motor-generator set. The water motor is started at the outset and supplied with water until the main generators are up to speed. Current is then thrown into the electric motor and it picks up the load, while the water is shut off from the water motor, allowing it to idle on the shaft, carrying no load.

Since it was found advisable to maintain the floor of the power house on one continuous level throughout, and owing to the large wheel diameters used for the various direct-connected turbine-driven units, the height of the power house floor has been carried through an elevation which would occasion the loss of considerable of the effective water head were the electrical units placed above it. In order to correct this as much as possible, and to obtain the greatest output from the electrical equipments consistent with the installation generally, the electrical units were depressed below the normal floor level as much as possible.

The automatic speed control of all units in the power house is accomplished by means of self-contained oil pressure governors which maintain the uniform speed of their individual turbine units by decreasing or increasing the size of the power jet impinging upon the turbine buckets. In thus automatically controlling the speeds of the units through the control of the volume of water delivered to them, the water supply is thoroughly conserved and thus made available to carry short peak loads which would otherwise be beyond the capacity of the plant. The time in which the governors must act in shutting off or increasing the supply of water to their respective turbines is very short, in order to provide proper speed regulation. In fact, all of the governors make their full strokes in three seconds or less.

It may be easily imagined what the effect would be upon the pipe line, if provision were not made in the automatic action of the governing apparatus to prevent excessive rise of pressure in the pipe line due to water ram, when for instance, the 1400-hp. turbine direct-connected to the blowing engine had its complete supply of water shut off by the governor. The pipe line is, however, thoroughly protected against any danger from this source by the use of automatically operated auxiliary relief nozzles simultaneously controlled by the automatic speed governors with the volume control of the power nozzles. In the event of a change of load occurring in such

manner as to require a very rapid decrease in the volume discharged from the power nozzle, the auxiliary relief nozzle rapidly opens and momentarily provides a discharge outlet for the water which has been playing upon the buckets. The relief nozzle then automatically and slowly returns to its closed position at a rate of speed which can be adjusted to prevent undue pressure rise in the pipe line and which is also entirely independent of the rate of motion of the governor.

Each of the turbine units is provided with a

main stop gate valve provided with a by-pass and suitable gearing proportioned so that one man can without difficulty operate even the largest gate in the power house when it is under the full pressure of the pipe line.

Full provision has been made throughout the plant for facility in the removal of any wearing parts and with a view to providing a high degree of continuous twenty-four hour a day service which is necessarily required in the operation of a pyritic smelting installation.

Problem Course in Electricity

BY H. H. BLISS

(The calculation of power, and the relation of the various terms in which power is expressed, are taken up here in the fifth article of the practical electricity series. Appended problems bring out the principles stated in the text. The author is on the staff of Riverside Junior College, Riverside, California.—The Editor.)

POWER AND EFFICIENCY

Calculating with Watts.—It is found by experiment that a certain engine can drive one generator that gives a current of 100 amperes with a pressure

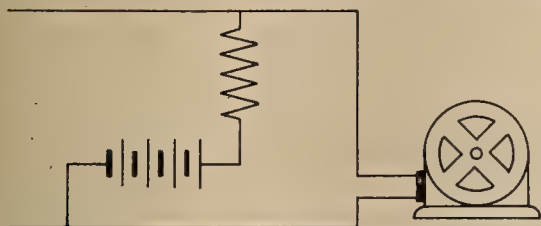


Fig. A. Diagram illustrating method of inserting sufficient resistance in series with a battery to limit the current.

of 500 volts, or another generator that gives 200 amperes at 250 volts, or a third that gives 1000 amperes at 50 volts. The power is the same in each case; you will note that the product of volts times amperes is 50,000 each time. It might be said that electric power = 50,000 "volt-amperes" but the common expression is 50,000 "watts." In a direct current circuit the Number of Watts = Number of Volts across the Circuit \times Number of Amperes Flowing.

The same product expresses the number of watts of power in an alternating current circuit, provided there are no complications due to condensers, coils or long lines; in other words, the formula applies to all ordinary lighting and heating circuits but not to those containing alternating current motors or transformers. In any circuit:

Power = Pressure \times Current \times Power Factor, the power factor being 100% or less, depending on circumstances.

If a lamp takes $\frac{1}{3}$ ampere at 120 volts, its "wattage" is $\frac{1}{3} \times 120 = 40$. How many amperes flow through a motor taking 1760 watts on a 440 volt circuit? Since watts = volts \times amperes; amperes = watts/volts = $1760/440 = 4$ amperes, answer.

The "watt formula" can be rearranged for use in finding volts or amperes, just as Ohm's Law could be rearranged for different purposes. To find the voltage to apply to a 550 watt iron taking 2.5 amperes, we divide watts by amperes: $550/2.5 = 220$

volts. In such cases it is best to check the solution by trying the original "watt formula"; here $220 \times 2.5 = 550$; in the example above, $4 \times 440 = 1760$.

Kilowatts, Horsepower, Kilovolt-amperes.—Except with such small apparatus as heaters, lamps, telephone apparatus and fractional horsepower motors, the watt is too small a unit for convenience. Hence we perform most power calculations in terms of the "kilowatt" (1000 watts). In certain cases it is necessary to convert kilowatts to horsepower and vice versa, which is most conveniently done if one remembers that 1 hp. (horsepower) = $\frac{3}{4}$ of 1 kw. (kilowatt) very nearly, and hence 1 kw. = $\frac{4}{3}$ of 1 hp.

Another unit frequently mentioned in connection with a.c. apparatus is the "kilovolt ampere." One "kilovolt" equals 1000 volts. If a 6000-volt generator is capable of supplying 80 amperes it is rated at 6×80 , or 480 kva. (kilovolt-amperes). Its load

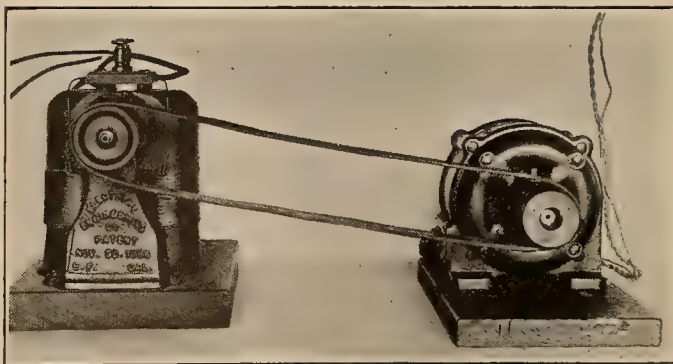


Fig. B. Motor generator set used for experiment in the evening electrical class at the San Francisco Polytechnic High School

may be 480 kw. if the power factor is 100%, or less, if the power factor is lower.

In a certain circuit the electrical hp. = 56 and the power factor = 60%; find the kva. We first change the power to kw.: $\frac{3}{4}$ of 56 = 42. Then, since

The major reserves of the nation's standing timber are found in the Pacific Northwest. The tremendous natural resources of this region have just begun to be developed.

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the kw. = kva. \times power factor, the kva. = $42 \div .60 = 70$.

Observe carefully the fact that the number of kw. is always less than the number of hp. representing the same power, since the kilowatt is a larger unit (the number of miles between San Francisco

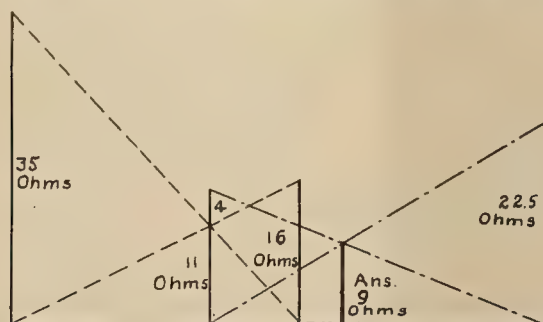


Fig. C. Diagram showing solution of problem 43. 16 and 35 ohms in multiple give an equivalent resistance of approximately 11 ohms; add 4 in series and find total for magnet, toaster and grid = 15 ohms. This in parallel with 22.5 gives 9 ohms for the whole combination.

and Los Angeles is less than the number of feet). Since it is $4/3$ as large a unit, there are only $3/4$ as many of the kilowatts. Keeping this point clearly in mind will help in making transformations from one kind of unit to another.

Electrical Efficiency.—If a man has to charge a storage battery which takes 40 amperes at 110 volts, and has a 550-volt d.c. line available, he can do it by inserting sufficient resistance in series with the battery to limit the current. (See Fig. A.) He would have to produce a "drop" of 440 volts in the resistance, when 40 amperes flow. Therefore he would need 11 ohms. This system has been used commercially, but it is generally disapproved as "inefficient."

A better scheme is to use a 550-volt motor, "direct-connected" to a 110-volt generator. This kind of combination, generally known as an "M-G set," is very much used for giving a different voltage or producing direct current from an a.c. supply, as for electric railways, battery charging, or running a motion picture projector.

The number of watts taken by the motor is called the "input" to the combination; the "output" of this M-G set would be the watts given out by the generator. With the figures given, the output = $40 \times 110 = 4400$ watts. **The output of any machine or system of machines is always less than the input.** This statement has been proved by hundreds of thousands of tests and experiments upon all sorts of devices. Hence the input to our M-G set is more than 4400 watts—probably about 7000 watts.

The "efficiency" of a machine is defined as the answer obtained by dividing the output of a machine by the input, or "**efficiency = output \div input.**" Our M-G set has an efficiency of $4400/7000$ or .63, generally written "63 per cent" or "63%." To the engineer efficiency means power delivered \div power taken in, or the percentage of a watt given out by an appliance for each watt consumed by it.

If we know the efficiency and input of a machine, we readily calculate the output by multiplying the

two known factors. Similarly, we can find the input by dividing the output by the efficiency, when these two things are known.

Answers to Problems on Multiple Circuits

33. Voltage = $1.25 \times 92 = 115$; heater current = $115/24 = 4.79$; line current = sum = **6.04 amperes.**

34. $485/5 = 97$ ohms; $110/97 = 1.134$ amperes.

35. From alignment chart, 10 and 2.5 give 2 ohms, hence combined resistance = **.002 ohms.** Voltage drop across meter = $12 \times .01 = .12$ volt; current = $.12/.002 = 60$ amperes.

36. $2.5 \times (7 + 29) = 90$ volts; $90/18 = 5$ amperes; $5 + 2.5 = 7.5$ amperes.

37. Volts = $3.6 \times 30 = 108$; B takes 4.5 amperes; total current = **10.8 amperes**; equivalent resistance = $108/10.8 = 10$ ohms.

38. Second lamp takes 1.5 amperes. Drop = $3.6 \times 1.6 = 5.76$; generator voltage = **113.76 volts.**

39. Lamp resistances are 51.4 and 72 ohms. $108/3.6 = 30$ ohms; $30 + 1.6 = 31.6$ ohms for circuit.

40. Trolley resistance = .093; feeder, .045; combined resistance = .0303 ohm. Track resistance = .021; total = $.021 + .0303 = .0513$. Drop = $130 \times .0513 = 6.7$ volts.

41. First reading = 60 volts. Two lamps in parallel have 80 ohms; total resistance then = $80 + 160 = 240$ ohms; current = .5 ampere; $.5 \times 160 = 80$ volts.

42. Coils are in series for "low heat"; total resistance = $220/.86 = 256$ ohms. Medium coil has $220/2.75 = 80$ ohms; the other has $256 - 80 = 176$ ohms. Current taken by second coil on 220 volts = $220/176 = 1.25$ amperes. For "high heat" coils are in multiple and total current = $1.25 + 2.75 = 4$ amperes.

43. 16 and 35 ohms in multiple give an equivalent resistance of approximately 11 ohms; add 4 in series and find total for magnet, toaster and grid = 15 ohms. This in parallel with 22.5 gives 9 ohms for the whole combination. (See Fig. C.)

44. $24/.1 = 240$ ohms; $240 - 83 - 37 = 120$ ohms in the lamp. By alignment chart, lamp and shunt give 30 ohms; $30 + 83 + 37 = 150$ ohms.

45. Man and one lamp in parallel have equivalent resistance = 1000 ohms; total resistance = 3400 ohms; amperes = $221/3400 = .065$. Drop in outer lamps = $.065 \times 2400 = 156$ volts, leaving 65 volts across man; current = $65/6000 \times .0108$ ampere. If lamp burns out his current increases to $221/8400 = .0263$ ampere.

Power Problems

46. What current flows through each of the following pieces of 220-volt apparatus? 15-watt lamp, 500-watt iron, 440-watt cooking unit?

47. What current is taken by a 27.5 ohm heater on a 110-volt circuit? How many watts? How many kw.? How many electrical hp.?

48. What current flows if 11,000 kw. are transmitted on two wires at 100,000 volts and 80% power factor?

49. A certain sewing machine motor takes 4 amperes and .12 kw. on a d.c. circuit. What is the voltage?

50. A 440-volt a.c. motor has an input of 19 kw. at a power factor of 90%. What current does it take?

51. This motor is 85% efficient. What is its output in kw. and hp.?

52. This same motor is direct-connected to a 150-volt d.c. generator which supplies to a storage battery a current of 92.7 amperes. Find the efficiency of the generator and the efficiency of the M-G set.

53. There are connected in series across a 110-volt circuit one heater of 20 ohms resistance, one resistance coil of 11 ohms, and three pieces of wire of .2 ohm each. Find the power used in the heater.

54. What current flows for a load of 45 kva. at 2300 volts and 90% power factor?

55. In Fig. B is shown an experimental M-G set. The a.c. motor (at the right) takes 6 amperes at 230 volts and 72% power factor. Find the current output from the 60-volt d.c. generator if the efficiency of the set is 57%.

56. A motor draws a current of 40 amperes through two line wires of .4 ohm each connected to a 220-volt gen-

erator. Find the power output of the generator, the input to the motor and the efficiency of the transmission.

57. What is the power factor in a transmission line where the kw. = 9,600, the voltage = 150,000 and the current = 80?

58. A long piece of "Nichrome" resistance wire is connected across a 224-volt circuit. It absorbs 1.8 kw. of power. Find the resistance of the wire.

59. Three electric lamps, of 200 ohms, 240 ohms, and 810 ohms respectively, are connected in multiple. Together they take 1.15 amperes. Find the circuit voltage and the power to each lamp.

60. Find the resistances of the following 110-volt lamps: 10 watt; 25 watt; 60 watt; 100 watt.

MAKING ONE SALE INTO TWO

BY M. T. DOLMAN

(Do you make the best of your selling opportunities? The following hints to contractor-dealers by the manager of the Sales Promotion Bureau of the Pacific States Electric Company indicate that the customer does not necessarily think of asking for everything he wants.—The Editor.)

"Need a tooth brush, sir?"

How many of you contractor-dealers have had that question shot at you by the clerk in the up-to-date drug store when you asked for a certain make of tooth paste, or powder?

That question was put as the clerk showed you the package of paste you had asked for, preparatory to wrapping it up for you. As he started toward the wrapping desk, the chances are that the clerk also reached for a bottle of mouth wash and showed you that, saying a few words in recommendation. Maybe you bought the brush, suddenly remembering that yours was rather worn and you would need a new one soon, anyhow. Or maybe you bought the mouth wash. Again, maybe you didn't buy either. Yet the chances are that, if the clerk was at all tactful when he made the suggestions he wrote two items on his check instead of one and drew down an extra p.m. as a result. That was salesmanship, in one of its neatest forms. That sort of salesmanship has put the drug stores into the "million-dollar-turn-over" class and given them a position in the retail world they never occupied before.

A man walks into a dealer's store and asks for some lamps. (Bulbs, he calls them, for the public hasn't yet been thoroughly unsold on that word as applied to electric lamps.) What do you do, or what does the clerk do? Most likely what I've seen many of them do. He reaches for a 25 or 40-watt clear, B Type lamp and proceeds to wrap it up, telling the customer the price. Out goes Mr. Customer and for weeks thereafter cusses electric lights. Never a word was asked as to where the customer intended to use those lamps, nor any effort made to sell the new White Mazda. Two lamps were sold—two lamps only. Not even good will was promoted, either for the lamps, the electrical industry or the dealer.

Now that is what had been happening daily in the store of a certain dealer whom I happened to visit one day, when just such a transaction as I have described, transpired. The "boss" of the store was busy figuring a wiring job. The clerk (I can't dignify him by calling him a salesman) didn't know his business, though he had been working for that dealer for three years. Both "boss" and employee were to blame—mostly the "boss."

I stood beside the counter where the man asked for the lamps and said nothing, until the clerk left to wrap up the lamps. Then, picking up a White Mazda which, as it happened, was lying on the counter, I said,

"Have you ever seen this lamp before? It's the very last word in electric lamps. Gives you a clear, well defined light for reading, yet, because of its character has none of the glare attendant on clear lamps."

He was interested, and never even stopped to ask who I was, or to notice that I wore my hat and was evidently a stranger and not part of the dealer's organization.

I stepped behind the counter and lighted the White Mazda for him. His face lit up in a smile and he said:

"That's just what I want. I want those bulbs for a living room table lamp, to read by."

"Best thing in the world for that," I said. "You take my advice. Take along half a dozen. Put two or three in your reading lamp. Put some in your bed room. Above all, put one in your bathroom over the mirror. See how much easier it will be to shave."

By that time the clerk had returned. But the customer said:

"I've changed my mind. This gentleman was showing me this new 'lamp,' as he calls it. I think I'll take half a dozen."

While the clerk was wrapping these up (unfortunately the counter was ten or twelve feet from the counter) I casually remarked:

"Ever have any trouble with your door bell batteries?"

"I should say I do! The darned bell don't work now. I'd forgotten all about it."

Then I explained about the bell ringing transformer. He thanked me and bought that, too.

That evening I remained over in the town, at the request of this particular dealer, who having sensed the transaction had stopped to watch what I did, and talked to him and his sales people. The result of that one little lesson has been to make this dealer one of our biggest sellers of White Mazda lamps, and one of the greatest boosters for small electrical specialties we have on our books. He is giving his salesmen a bonus every time they have two or more items on a check. His volume has doubled, and with it his net profits.

INDUSTRIAL USES OF RADIO

Radio experimenters seem to be bound and determined that distance shall not be considered as a factor in any of our present day processes such as the making of talking machine records. The speaker talks into a high-power instrument which transmits the voice several hundreds of miles to the receiving point where a recorder which engraves the message in soft wax is attached. A record made recently was perfect though a trifle "patchy" when produced.

The tremendous markets of the Orient are most easily reached from the Pacific Coast.

FORWARD WESTERN INDUSTRY!

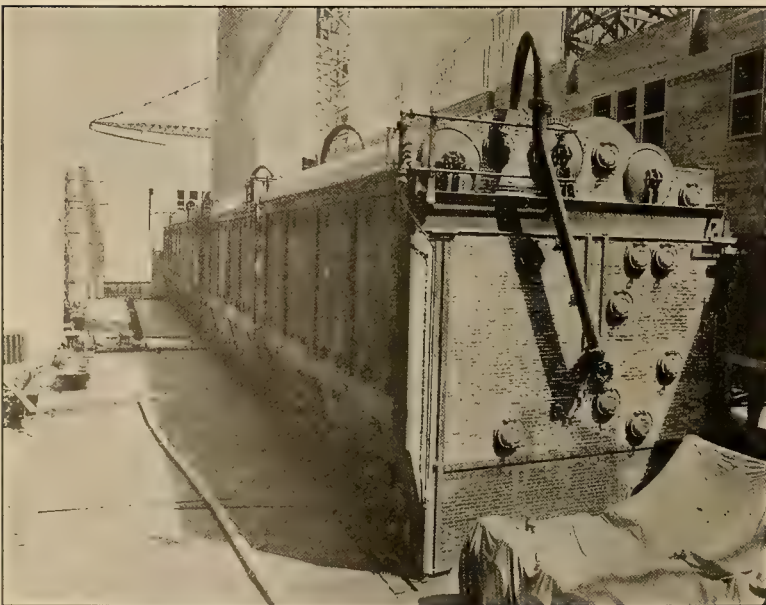
Meeting the Power Shortage in the West

(By means of an unusual network of interconnections, steam power plants are assisting hydro-electric installations to supply the great power demand of the West during these months of shortage. Among the views on these pages, the water softening plant of the Sierra and San Francisco Power Company, the float arrangement at a Southern California Edison Company plant and of an oil fire steam heating station of the Pacific Gas & Electric Company, are of especial interest.—The Editor.)

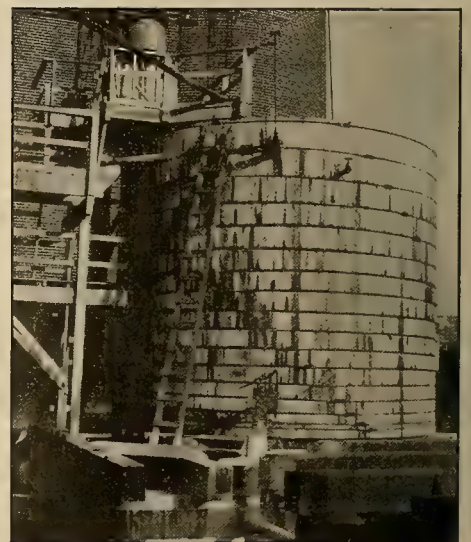


TYPICAL BOILER ROOM FOR EASY CHANGEOVER FROM OIL TO COAL

Many power plant operators prefer to so design the fuel oil operation that quick changeover to coal operation may be accomplished should oil later involve less economic operation than coal. The view shown is that of the boiler room of the steam electric plant for the lighting department of the city of Seattle—East Lake Avenue and Highland Place.



Boiler installation at the Long Beach Plant of the Southern California Edison Company under construction

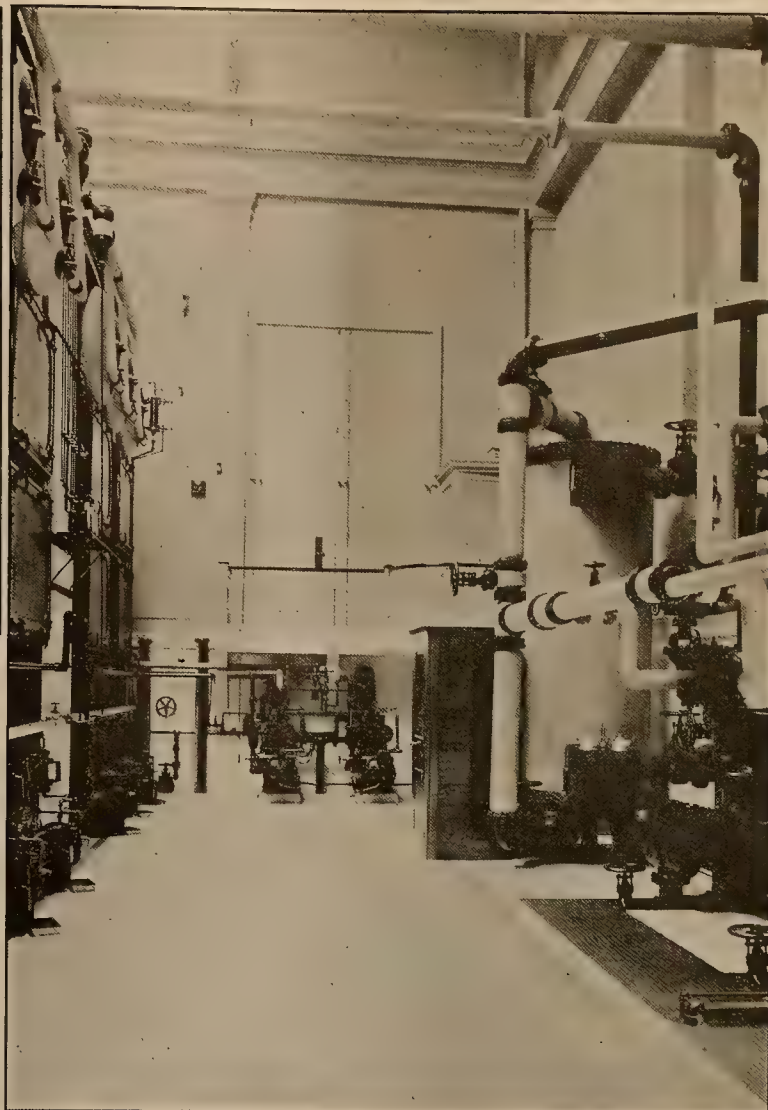


Water softening plant at the Sierra and San Francisco Power Company's 17,000-kw. oil burning station. The use of pure water free from scale-forming matter is the first requisite toward keeping boilers clean.



The above is a view of the float arrangements, showing the valves which control the inlet and outlet of oil from storage tanks of Long Beach Plant, Southern California Edison Company.

The oil-fired steam heating station, Pacific Gas & Electric Company, Station S, San Francisco, is shown to the right. B & W boilers are to the left, fuel oil pumps and heaters in the center of background, feed water pumps and heater to the right.



The mechanical fuel oil atomizers installed under two 250-hp. Heine boilers. The view is the standard equipment at eleven pumping stations of the Shell Company of California Oil Pipe Line, installed by Sanderson and Porter. The operation is entirely automatic, oil being supplied to the burners under the control of the pump governors so as to maintain constant pressure.

A New Plan of Distribution

BY GLEN H. SMITH

(Increased efficiency in the distribution of power is in line with the present need for full utilization of all electric power resources. Following is a description of a new arrangement in the city of Seattle, written by the engineer of outside construction on the Seattle Municipal Light & Power System.—The Editor.)

Some radical changes are to be made in the city distributing system of the Seattle municipal plant as rapidly as present plans can be carried out. Some of the features proposed are different from anything used in any city in the country.

The proposed changes, in brief, consist in changing a 15,000-volt, 2-phase system to 3-phase with 15,000 volts to neutral, and the extension of this

At Fremont the current is stepped down to 2500 volts with a drop of 1% and sent through the usual oil switch and automatic induction regulator to the primary feeder. This feeder of two 350,000 C.M. cables, carries the load of 300 amperes 12,000 feet to a distributing center at 14th Avenue Northeast and East 45th Street, with a drop of 15%. From the distributing center a primary network spreads in all directions, reaching an extreme length of 16,000 feet, using wire from No. 0 to No. 6, and giving a voltage drop of 10% from distributing center to extreme end. The distributing transformer adds 2% drop, and the bus and service another 2%, making a grand total of 34.3% to be compensated in order to get constant potential service. Theoretically this can all be

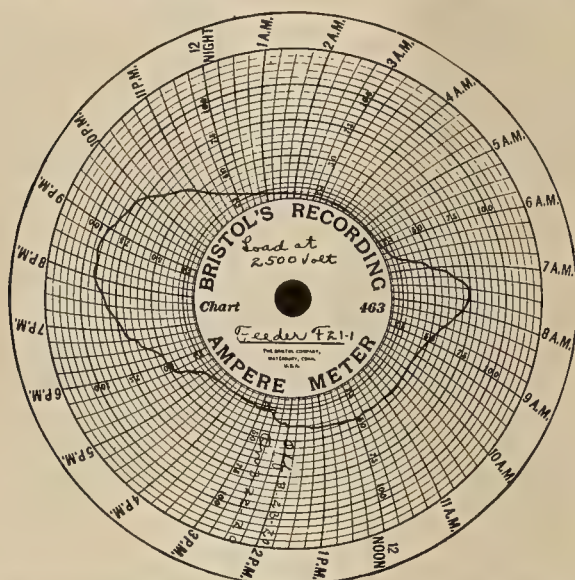


Chart showing current used by district which has been changed to new system

system into each district now served by primary, with the shortening of the primary feeder to a maximum of two or three thousand feet and consequent elimination of the feeder regulator. The idea is to substitute a high voltage system for the long primary feeders, and so subdivide the primary districts that the customer at the feeding point of the district nearest the station will receive the same voltage as the one at the extremity of the most remote district, within the three or four-volt variation permissible on the tungsten lamp.

Details of the New Plan

To illustrate, let us take a typical primary district, such as the University section, and trace the current from generating station to customer on the old and the new plans of distribution. The district uses 750 kilowatts at 120-240 volts single phase for light with about 100 kilowatts of polyphase power—a total of 800 kw. on the lighting phase. Current is taken from the bus at the Lake Union steam plant at 15,000 volts and carried by two-phase line to the Fremont substation, 15,000 feet. The full load regulation on this section of line, which is of No. 2 wire most of the way and designed for 4000 kva., is approximately $4\frac{1}{3}\%$, while the drop due to the 800 kilowatts under consideration is $1\frac{2}{3}\%$ on its phase.



Typical outdoor substation in the residence district

taken care of by regulator and by raising the bus except the 10% from feeding point to the end of the primary, provided that the load comes on at the same time throughout the district. In practice the voltage at the feeding point is raised over the peak to 3% or 4% above the standard voltage, so that the average over the district is correct, with the nearest customers getting high and the farthest low voltage. The abnormal drop of 15% in the feeder itself is partly taken care of by a 10% fixed booster at the substation, the remainder by automatic regulator. It may be noted that the inductive component of this drop is 933 volts against 224 volts due to resistance; also that the feeder wire is by no means overloaded.

Method of Changing

To substitute the new method of distribution for the one outlined above for this district, we change the voltage on the steam plant busses to 15,000 to neutral, 3-phase, or 25,980 volts between wires, take down two wires of the five-wire, two-phase system, and extend the line past the present station, past the

present distributing point and on to within 4000 feet of the end of the primary network. We cut this network into quarters, and install a 250-kw., 26,000 to 2500-volt transformer at the center of each quarter and tie the network to it through a disconnecting switch and take down the heavy feed wires. We now have $1\frac{1}{2}\%$ drop from steam plant to Fremont, one-third of what we had before, and from Fremont to the old feeding point we have one-fourth of one per cent, instead of 15%, or one-sixtieth of the former drop. From each new feeding point to the end of the primary is now half as far as before, with one-quarter of the current to send in each direction, reducing voltage drop to one-eighth, or $1\frac{1}{4}\%$ maximum. This is the drop which can not be compensated for because it is "between consumers." Step down transformers, distributing transformers, secondary bus and service introduce a five per cent drop as before, but this, with the two per cent on the 26,000-volt line, can be compensated by raising the station bus voltage over the peak.

We have reduced the drop between station and customer from 34.2% to 8% with a reduction in power loss from 28% to 8%, and given service to the farthest consumer better than that formerly given at the feeding point. At the same time we have reduced the expense for apparatus including wire, insulators, transformers and regulators, from station to feeding point about 35 per cent and increased the capacity of the circuits from two to thirty-three times.

Advantages of New System

With the new system the entire city will require only three stations, the Skagit step-down station in the north end and Cedar River step-down station in the south, with the steam plant in the center. The busses in the three stations will be regulated for the same voltage by synchronous condensers, regardless of the direction of the flow of power between them. The 15,000-volt system will become simply an overgrown primary system, with transformers placed wherever necessary for the lighting load. Additional circuits will be necessary between stations for tie lines, and the largest power loads will require power lines separate from the lighting circuits.

The operation of such a system is very simple. Each transformer is inspected periodically and graphic load charts taken frequently enough to guard against overload. Each primary district may be tied to the neighboring one when work must be done on 15,000-volt lines or transformers. In cases of short circuit on the primary system, a district must be out until the troubleman can be sent to the district, but the area affected will be only one-fourth as large as formerly. The effect of trouble on the 15,000-volt lines will not change; such trouble will be reduced as construction is improved.

From the safety standpoint the two systems stand equal. Lines of any voltage above 2500 must be killed before they can be handled. The safety depends almost entirely on the class of construction and the care in operating. The reconstruction of old 15,000-volt lines using modern insulators and switches, larger crossarms and better safety factors

in general will greatly improve their safety. Insulators of three distinct colors, brown, blue and white, are to be used for designating the three phases, both for safety and for convenience of operating.

This plan has been tried out in part, on the city's system for ten years, and is being used on the present 15,000-volt, two-phase system as the best and cheapest means of relief for overload feeders. There are now seven primary districts in operation, with three more under construction and four more to be added as rapidly as possible. So far, the system has proved satisfactory beyond expectation.

MECHANICAL ANALOGS — III.

BY G. R. SCHUCK

(A comparative summary of the mechanical and electrical relationships analyzed in the article appearing in the last issue is given here in the third paper of the Mechanical Analogs series. The author is a member of the electrical engineering department of the University of Washington.—The Editor.)

An examination of Figs. 1 and 3 together with the curves representing pressure, electromotive force, fluid flow and flow of electricity which may be

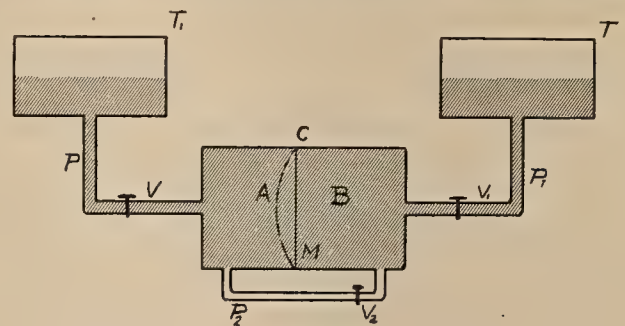


Fig. 1

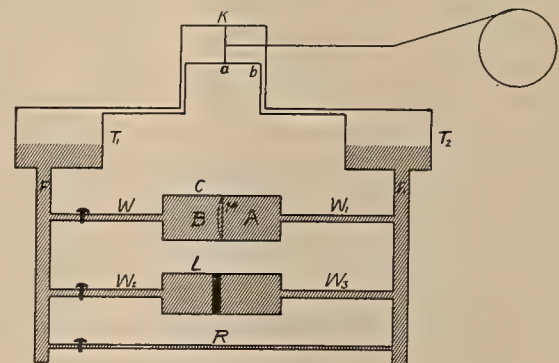


Fig. 3

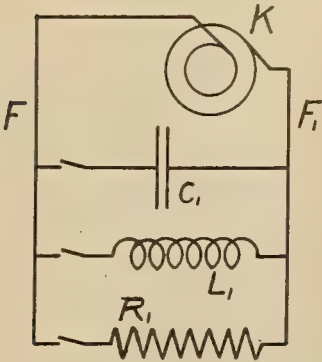
found in the previous article appearing in the September 1st issue of Journal of Electricity, will lead to the following conclusions.

1. A condenser connected across the mains of an alternating current circuit acts as an absorbing or elastic medium, a charge of electricity being absorbed by the dielectric during one part of the cycle and returned to the circuit during the other part of

The West now purchases \$30 worth of electrical appliances per capita as compared with \$7 in the rest of the country. Industrial development means general development and an even higher purchasing power.

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the cycle, as is the membrane M, stretched first in one direction and then in another, causing a flow in and out of the condenser ninety degrees or a quarter period in advance of the electromotive force, or in



This diagram illustrates the electric principles shown in the mechanical analog in Figure 3. The maximum electromagnetic energy in this inductive circuit is $\frac{1}{2} L_1^2$.

other words, ninety degrees out of phase with the electromotive force. The maximum potential energy stored up in the stretched membrane M is proportional to the product of the average force exerted on the membrane from the time it is in its maximum state of stress until it is in its neutral position, and the volume or quantity of fluid displaced. Potential energy is proportional to $\frac{E q}{2}$. The volume of dis-

placement is proportional to the product of the pressure E and the capability K of the membrane to be stretched under unit pressure. Therefore potential energy is proportional to $\frac{1}{2} K E^2$. Also the maximum electrostatic energy stored in a condenser equals $\frac{1}{2} C E^2$.

2. An inductance coil connected across alternating current mains acts in the nature of inertia of mass. This inertia tends to oppose any change of current and retards the current ninety degrees or a quarter period behind the electromotive force, or in other words the current lags ninety degrees out of phase with the electromotive force. The coefficient of self induction L, which is a measure of a circuit's ability to induce counter electric motive force or self induction, takes the same part in electrical phenomena as do masses such as M in mechanical mechanisms. The maximum kinetic energy of the mass D in Fig. 3 is $\frac{1}{2} M V^2$. The maximum electromagnetic energy in the inductive circuit of Fig. 5 is $\frac{1}{2} L I^2$.

3. A non-inductive resistance connected across the alternating current mains acts in the nature of mechanical friction having no retarding or absorbing properties. The curve of current is practically the same shape as the curve of the electromotive force, and exactly coincides in time relation with it; in other words, the current is in phase with the voltage and the power factor is unity.

TABLE I—QUALITIES OF REFLECTORS OF DIFFERENT FORMS

Qualities	Metal, porcelain-enameled			Glass	
	Shallow-bowl or dome, 15 degree cut-off angle	Deep-bowl	Shallow-bowl lamp fitted with shield or cap	Deep-bowl mirrored glass	Deep-bowl prismatic glass
Horizontal illumination	Excellent	Fair	Fair	Excellent	Excellent
Vertical illumination	Good	Poor	Poor	Fair	Excellent
Ease of maintenance	Excellent	Excellent	Fair	Fair	Fair
Non-liability to breakage	Excellent	Excellent	Excellent	Fair	Good
Non-liability to deterioration	Excellent	Excellent	Good	Fair	Excellent
Avoidance of eye strain from direct glare	(See Note)	Good	Excellent	Good	Good
Avoidance of glare from polished surfaces	(See Note)	Poor	Excellent	Poor	Poor

Note—The glare from clear lamps is greater with shallow-bowl or dome reflectors than with other types. To prevent excessive glare the lamps should either be frosted or be equipped with opal glass caps, unless mounted at least 20 feet above the floor.

TABLE II—SIZE OF LAMPS AND SPACING REQUIRED FOR VARIOUS INTENSITIES OF ILLUMINATION

The intensities recommended for various operations are given in the text.
L= Lamp size in watts; S= Spacing in feet. (These values do not apply to indirect lighting.)

Foot Candles	Vacuum Tungsten	Gas filled tungsten									
		L	S	L	S	L	S	L	S	L	S
1/4	50—28	75—39	100—48	150—61	200—72	300—66					
1/2	50—20	75—28	100—34	150—43	200—52	300—47					
1	50—14	75—19	100—24	150—31	200—36	300—33	400—35	500—45	750—56	1000—61	
2	50—10	75—14	100—17	150—22	200—26	300—27	400—32	500—36	750—46	1000—54	
3	50—8	75—11	100—14	150—18	200—21	300—24	400—28	500—32	750—40	1000—47	
4		75—10	100—12	150—15	200—18	300—21	400—23	500—26	750—33	1000—38	
5			100—11	150—14	200—16	300—21	400—25	500—28	750—36	1000—42	
6			100—10	150—12 1/2	200—15	300—19	400—23	500—26	750—33	1000—38	
8				150—11	200—13	300—17	400—20	500—22	750—28	1000—33	
10					200—11	300—15	400—18	500—20	750—25	1000—30	
12						300—13 1/2	400—16	500—18	750—23	1000—27	
15						300—12	400—14	500—16	750—20	1000—24	

ILLUMINATION BY DIRECT LIGHTING

The accompanying table taken from the Electric Journal will prove useful to contractors who are doing wiring jobs on industrial plants. The distance apart that the lamps are spaced depends upon the character of illumination required.

DESIRABLE SPACING

Ceiling Height	Fine Work	Rough Work
10 feet	8 to 10 feet	10 to 12 1/2 feet
12 feet	11 to 14 feet	14 to 17 feet
14 feet	13 to 17 feet	17 to 21 feet
16 feet	16 to 20 feet	20 to 25 feet
20 feet	21 to 26 feet	26 to 33 feet
25 feet	27 to 35 feet	35 to 43 feet
32 feet	35 to 45 feet	45 to 56 feet

The following recommendations for intensities in different industries are given only as a guide, as each industry has its own requirements that must be met.

Character of Work	Intensity in Foot Candles
Ordinary Metal or Woodworking Shop,	4
Tool Making, Pattern Making and Light Colored Textile Work.....	8
Foundry Work	4-6



View across the city of Spokane, from the top of the Davenport Hotel where the convention was held. Near the center of the picture can be seen the famous Monroe Street bridge built over the falls in the center of the city with the Washington Water Power Company's power house below.

The Spokane Convention

(Another page of electrical history has been written by the Northwest Electric Light and Power Association at its Spokane Convention September 8th to 11th. Its adoption of the plan for a cooperative electrical league is one of the most significant events of the year, and together with the other features outlined below, has made the convention one long to be remembered.—The Editor.)

One hundred and sixty members and guests reported in the initial registration of the Thirteenth Annual Convention of the Northwest Electric Light and Power Association.

A note of optimism on public utility prospects for the coming year was sounded by President Fisk in his opening address, together with an appeal for united action in facing problems which still remain. Among bettering conditions he placed the labor situation, fair allowance of rates, and public interest in utility financing and municipal ownership situation. Much remains to be done in lessening the burden of taxation, and in making provision, in rate fixing, for the fluctuating dollar. The tendency of municipalities to take over regulation from state utility commissions, said President Fisk, should be met by a firm stand.

Adjustment of local interests to National Association needs is still going on, and a new constitution for the Northwest Section is at present under discussion. An eleven-fold program was outlined by the Commercial Committee, R. W. Clark of Puget Sound Power & Light Company, chairman, as follows:

1. Cost data on competitive versus other service.
2. Successful efficiency methods in all departments.
3. Methods found practical in securing rate increases.
4. Elimination of gratuitous service.
5. Educational campaigns.
6. Customer ownership campaigns.
7. Increase of demand.
8. Policy on special transformers for special devices.
9. Demarkation between transmission and distribution, with what voltage to rural districts.
10. Rates to new and old customers.
11. Classification of costs into main divisions of service.

George L. Myers of the Pacific Power & Light Company, for the Oregon Publicity Committee, pre-

sented plans for the formation of a representative power company committee on public relations in Oregon. The need for uniform interpretation of accounting clauses relative to deferred maintenance was brought out in discussions of the Accounting Section report. W. R. Putnam, manager of the Idaho Power Company, reported on the proposed joint meeting of power companies and commissions to straighten out publications between states. A joint luncheon meeting of convention and advertising men was addressed by Robert Sibley, editor of the Journal of Electricity, on the self-interest idea.

The Northwest Electrical Service League

The most important work before the convention, however, was undoubtedly the adoption of the plan for the Northwest Electric Service League. This was presented by R. W. Clark, Puget Sound Power & Light Company, chairman of the committee, and ably seconded by A. C. McMicken, Portland Railway Light & Power Company, and J. V. Strange, Pacific Power & Light Company. J. R. Tomlinson, of the Pierce Tomlinson Electric Company, Portland, Ray C. Kenney, of NePage McKenny Company, and W. M. Meacham of Meacham and Babcock, presented the support of the contractor-dealers, and J. I. Colwell, Western Electric Company, Seattle, spoke for the jobbers. The report of the committee is in part as follows:

Your Advisory Committee recommends that a permanent organization for the cooperation of elec-

The passage of the water power bill makes possible the development of the water power to meet the needs of industrial growth.

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trical interests in the Northwest be formed to be known as the Northwest Electrical Service League.

Purpose —

The aim of this Service League is to promote the growth of the electrical industry in all its branches through the co-ordination of effort in the rendering of better electrical service to the public, based upon the conviction that more efficient electrical service as a whole to the public will elevate our industry to a plane that its merit and usefulness deserve.

Its activities shall be directed along constructive lines within the industry in the way of encouraging sound, ethical and progressive business methods that will result in a fair and reasonable profit based upon service rendered to the public.

Its activities shall also be directed along educational lines without the industry, legitimately to increase the use of electricity and electrical equipment by the general public to the mutual interest of all branches of the electrical business.

Management —

Your Committee considers as essential to the success of this movement that a permanent Advisory Committee be created representing the active branches of the electrical industry in the states of Oregon, Washington, Idaho, Montana and Utah, the personnel to be drawn on some proper basis from central stations, contractor-dealers, jobbers and manufacturers. This committee should direct the activities of the League, the immediate direction, of course, to be in the hands of a management committee drawn from the advisory group in accordance with the extension of this work in the respective states (which will be referred to later), the service of the Advisory Committee to be rendered without compensation.

Organization —

Your Committee recommends that a working organization be employed consisting of a manager-secretary and an office assistant to the manager-secretary, also two field representatives.

The duties of the manager-secretary are as follows:

1. Attend all meetings of the Advisory Committee and make proper record of its proceedings.
2. Assist the Chairman in the supervision of the work and the details of the Service League.
3. Analyze the weekly reports and work of the field men and submit to the Advisory Committee a digest of same for its information and consideration.
4. Supplement the work of the field men with follow-up letters.
5. Prepare bulletins of an educational nature on the principles, practices and methods of successful retail merchandising.
6. Prepare and send to all contributors monthly reports of the progress of the Service League.
7. Prepare from time to time for the electrical press and newspapers articles concerning the League's activities.
8. And address meetings of electrical organizations, architects, home builders, improvement clubs, etc., on the various phases of the electrical business and its development.

Under the direction of the manager-secretary the field representatives are to visit and work throughout the district with contractor-dealers, power company managers and employees, making reports at frequent intervals direct to headquarters.

In general their duties are as follows:

1. When practical, arrange joint meetings of all electrical men in each city visited for a discussion of their common interests and problems.
2. Call upon and urge power company managers and employees to co-operate closely with contractors and dealers and their associations and promote a better acquaintance between power company employees and contractor-dealers, that each may better understand the problems and functions of the other.
3. Attend when possible local or sectional meetings of electrical contractors and dealers in their territories as often as time permits, taking an active part in these meetings and stimulating interest in the League's activities.
4. Call upon and assist both electrical contractors and dealers, explaining good merchandising principles and practices, and pointing out in each case means and ways of improving the individual business, emphasizing especially:
 - (a) The necessity of giving service to the public, explaining the elements and practices that go to make good service.
 - (b) The work of the League and the actual results achieved by electrical contractors and dealers who have followed recommendations.
 - (c) The necessity of electrical contractors and dealers co-operating with each other, explaining how each branch of the electrical contractor-dealer business depends upon the other for success.
 - (d) The advantages of membership in the State Associations and the National Association of Electrical Contractors and Dealers and of organizing sections in which local problems can be discussed at weekly meetings.

- (e) The importance of cooperation and personal acquaintance with power company managers and employees and the necessity of giving prompt attention to the work referred to them by the power company.
 - (f) The sphere of advertising in expanding the business and in building up good will for both the electrical contractors and dealers.
 - (g) The importance of correct accounting, both to the electrical contractor and the dealer, promoting the use of the complete or simplified standard accounting system as each individual case may require.
 - (h) The necessity of having all owners, architects and home builders provide sufficient outlets for present and future use of electrical appliances.
 - (i) The value to the electrical contractor of a definite place of business and to the electrical dealer of an ideal retail location.
 - (j) The benefits to be gained by the electrical contractors by the use of high quality material and workmanship and standard estimating forms.
 - (k) The necessity of each individual electrical contractor itemizing all items of overhead expense and determining a fair average percentage for his overhead charges.
 - (l) The proper arrangement of electrical stores and the correct presentation by the dealer of his merchandise to the public through floor and window displays (to assist in which work the field men will take and show to the dealers photographs of satisfactory arrangements and displays).
 - (m) Cooperation with the Industrial Accident Commission and the necessity for rigid compliance with orders issued by the Commission.
5. Establish personal contact with architects and builders and attend their meetings.
 - (a) Call to the attention of architects and builders the service that can be rendered their clients by providing their homes, offices and other buildings with complete electrical service, adequate wiring and sufficient outlets for present and future use of electrical appliances.
 - (b) Encourage the electrical contractors to cooperate with the architects and home builders.
 - (c) Discuss and endeavor to correct grievances that any architect or builder may have with any particular contractor or other member of the electrical industry.
 - (d) Point out to all electrical contractors and dealers with whom they come in contact that it is their duty to the industry to spread the propaganda of adequate wiring and sufficient outlets for present and future use.

The schedule of duties as outlined above has been taken with slight modifications, from the last annual report of the California plan, and is obviously the result of their several years of practical experience.

The general impression of the Advisory Committee, based upon observation and reports, is that conditions at this writing are such that it would perhaps be more advisable to project this plan for the immediate future in the two states offering the most favorable conditions for satisfactory results, namely, Oregon and Washington, with a tentative plan for expansion into the other states of the district at an appropriate time when the circumstances warrant and the electrical trade therein would be benefited to a sufficient degree.

An analysis, however, of this idea by the Committee discloses sufficient merit to justify the hope that such a plan will in the course of time find its activities producing wholesome results in the entire five states of this geographic section.

Financing —

As a result of a survey of the work to be carried on, your Advisory Committee has determined that a budget of \$25,000 should be provided for the first year's work of the League in Oregon and Washington. As a method of procedure in the raising of this fund, the Committee offers the suggestion that the following percentages would be equitable for division by the interests participating:

Contractor-Dealers	12%
Jobbers	23%
Manufacturers	30%
Central Stations	35%

Conclusion —

Based upon the instructions accompanying the assignment of this Committee, we have approached the subject from the viewpoint that there is a growing feeling in the Northwest that it would be advantageous to have a program that would coordinate in an efficient way the efforts of all the electrical interests in this great Northwest, and have endeavored to work out in an impersonal way the above plan.

It is the belief of the Committee that the creation and building up, along sound lines, of such an institution as this over a period of years will provide a vehicle by which it will be possible to add many millions of dollars to the gross income of the electrical interests of the district in excess of that which will accrue over a substantial period with the apparent unrelated efforts of the various interests that now exist.

Evidence in abundance exists of tangible results from coordinated effort along this line not only in the electrical business but in other industries, and it does not require a

great stretch of vision for any conscientious individual in any branch of our business to forecast the possibilities not only of improvement but of something more nearly approaching the saturation point in the electrical business by having machinery through which all individual and collective electrical interests can find a common point of interest.

ADVISORY COMMITTEE ON THE CO-OPERATION OF ELECTRICAL INTERESTS

F. N. Averill, Fobes Supply Co., Portland, Ore.; L. A. Lewis, Washington Water Power Co., Spokane, Wash.; W. R. Putnam, Idaho Power Co., Boise, Idaho; R. F. Bailey, Utah Power & Light Co., Salt Lake City, Utah; J. Ryan Gaul, Montana Power Co., Butte, Montana; J. F. NePage, NePage McKenny, Portland, Ore.; W. M. Meacham, Meacham & Babcock, Seattle, Wash.; J. I. Colwell, Western Electric Co., Seattle, Wash.; R. T. Stafford, Allis-Chalmers Mfg. Co., Seattle, Wash.; J. R. Tomlinson, Pierce-Tomlinson Electric Co., Portland, Ore.; Roy C. Kenney, NePage McKenny, Portland, Ore.; A. C. McMicken, Portland Railway Light & Power Co., Portland, Ore.; J. V. Strange, Pacific Power & Light Co., Portland, Ore.; C. B. Hawley, Intermountain Electric Co., Salt Lake City, Utah; Hugh Bargon, Montana Electric Co., Butte, Mont.; W. D. McDonald, Westinghouse Electric & Manufacturing Co., Seattle, Wash.; A. S. Moody, General Electric Co., Portland, Ore.; R. W. Clark, chairman, Puget Sound Power & Light Co., Seattle, Wash.

The story of the California Electrical Cooperative Campaign was presented by D. E. Harris, Pacific States Electric Company, San Francisco, Clotilde Grunsky, associate editor of the Journal of Electricity, and Robert Sibley. There were expressions of enthusiastic support from all branches of the industry. The report was unanimously adopted and recommended to the executive committee for the formation of a campaign in Oregon and Washington, with other states to follow.

Papers and Discussions

As the first item on the second day's program W. M. Leavitt, secretary of the Western Cedar Association, presented a paper on pole treatment, outlining a puncturing process which gives maximum saturation and results. Technical reports were presented by George E. Quinan, chief electrical engineer with the Puget Sound Power & Light Company, and comprised a broad survey of Northwest problems. In the discussion of the meter report the importance of the education of meter readers was emphasized as well as the necessity for commercial and accounting men appreciating accuracy of meters. Of one hundred thousand tested, ninety-five per cent were found accurate and four per cent favored the public.

An appeal was made by H. J. Gille, sales manager with the Puget Sound Power & Light Company, for a study of power-factor recording apparatus to meet the growing Western problem. In presenting the apparatus report, F. D. Nims of Everett, Wash., urged the special responsibility of the West for hydroelectric research. The necessity for the study of oil switches was brought out by S. C. Lindsay, engineer with the Puget Sound Power and Light Company, who said that the Western plants were growing beyond the capacity of those now manufactured.

George E. Quinan presented the report on inductive interference, a problem which is of primary importance as shown by the many appeals for assistance in law cases. Fundamental principles have been tentatively adopted and a program outlined. The cooperation of communication interests was promised by D. I. Cone, engineer with the Pacific Telephone & Telegraph Company, who spoke for the telephone company. There was a general feeling that a good beginning has been made toward allaying the interference situation.

The Thursday evening open meeting was addressed by Dr. W. J. Hindley on the Future of the Northwest, and by Robert Sibley on the Status of the Electrical Industry in the West.

On Friday William M. Hamilton of the Portland Railway Light & Power Company delivered an address on Public Utility Management of the Future, in place of Franklin T. Griffith, emphasizing the importance of the question of national work, particularly the question of having the same public policy program throughout the country.

Important problems of overhead construction were presented at the Friday session, with a constructive program for the coming year. In addition, problems of underground construction and electrolysis were discussed.

The report of the committee on safety rules showed that a better understanding of Northwest problems by the Bureau of Standards as well as by Eastern utilities had resulted from this work.

A review of the range and water heater report also brought out active discussion. A more detailed treatment of the many interesting papers presented will appear in the next issue of the Journal of Electricity.

Entertainment

The importance of the business transacted at the convention by no means obscured the social side of the gathering. Numerous delightful entertainment features had been planned, especially for the ladies, and on Saturday at the close of the business sessions the delegates and their friends adjourned in a body to Hayden Lake for golf and other sports.

New President Elected

Franklin T. Griffith, president of the Portland Railway Light & Power Company and a vice-



president of the National Electric Light Association, is the newly elected president of the Northwest Electric Light and Power Association, succeeding John B. Fisk. Mr. Griffith was this year re-appointed to the chairmanship of the Water Power Committee of the National Electric Light Association, his fine work in this connection having

been one of the features of the organization's accomplishments last year. The confidence which this re-appointment signified is echoed in Mr. Griffith's election to the presidency of the Northwest Geographic Section. The Association is to be congratulated on its choice, and on the active and successful year which Mr. Griffith's leadership assures.

The West is growing at a rapid rate both in population and in the development of its natural resources. Industrial development should keep pace.

FORWARD WESTERN INDUSTRY!

SPARKS—Current Facts, Figures and Fancy

(Fish stories from the island of Guam, an Irish reason for wireless telegraphy, the cost of a good thunderstorm and also of a cup of coffee, together with sundry other items of more than passing interest gathered together from all over the world, are here presented for the amusement and instruction of the curious reader.—The Editor.)

Under a rent restriction act in England a landlord is prohibited from increasing the rent more than 10 per cent.

* * *

The largest oil well in the world is located in Mexico and is known as the Cerro Azril No. 7. It is yielding 270,000 barrels of oil every twenty-four hours.

* * *

It has been estimated by a European scientist that the commercial value of the electricity in a flash of lightning lasting one-thousandth of a second is 29 cents. Now we know what the newspaper headlines mean when they say, "25,000 Storm Hits Middle West."

* * *

Of course, North America would like very much to rank first among the continents of the earth in the height of mountains, but these certain articles are rather difficult to extend. Nevertheless we are only third upon the list. Asia has Mount Everest, which stands 29,002 feet above sea level, and South America has Mount Aconcagua of the Andean system, which is 23,080 feet high. North America comes next with Mount McKinley, in Alaska, 20,300 feet above sea level.

* * *

Farmers of the Philippines are to learn how to work at the movies. The Department of Agriculture and Natural Resources of those islands plans to arouse a true appreciation of the possibilities of agricultural machinery by presenting the most approved methods of cultivation, preparation of seed, use of farm machinery and other phases of farming on the movie screen. Considerable success has already been experienced in advertising machine stripping rather than salt water retting in the preparation of maguey fiber for the market.

* * *

Electrification advances in Japan. According to the provisions of a bill recently introduced in the Diet for the complete electrification of the railways of Japan, the government would invest 50,000,000 yen in a semi-governmental electric power company, which would be capitalized at 100,000,000 yen. While the company would generate power primarily for the Railway Department, any surplus of current would be disposed of to private concerns. It is further understood that the government contemplates erecting the largest hydroelectric plant in Japan on the River Shinanogawa near Tokyo, which would probably be supplemented by a large steam plant, also near Tokyo.

How much do you think our morning cup of coffee costs? The most recent figures on this subject show that at the present time the American people are paying over a million dollars a day for this most popular of all popular beverages.

* * *

It seems there are ways and ways of catching fish. For instance, in Guam they lower the fruit of a native tree into the water. During the night this stupefies the fish that come near and brings them to the surface where they are easily caught.

* * *

It won't be long until they're all typing in China. The new Chinese language adopted in 1918 has greatly simplified Chinese lettering, making it possible to print with the typewriter. And now reports come that American manufacturers are seriously taking up the production of Chinese typewriters.

* * *

We might say that trouble is the mother of progress since the frequent cutting of telephone and telegraph wires in Ireland is forcing the installation of an extensive system of wireless telephony. Naval signal men are being employed to start the system, and it is reported that portable telephones with a radius of about thirty miles are being employed in transmitting messages from one police station to another, or between adjacent towns.

* * *

California ranks fifth among the states of the Union, based on a recently compiled comparison of resources of state banks. This is a statement of the condition of all banks under state control, furnished by the heads of the state bank departments. New York, of course, leads the nation with resources, \$7,298,000,000; Massachusetts comes next, with \$2,096,000,000; Illinois, fourth, with \$1,819,000,000; California, fifth, with \$1,347,000,000. The only other state in the billion class is Michigan, with \$1,057,000,000.

* * *

The national debts of the world now approximate \$265,000,000,000 against \$44,000,000,000 at the beginning of the great European war. The interest charges on the grand total now exceed \$9,000,000,000 per annum, as against about \$1,750,000,000 in the year before the war. The per capita of national indebtedness averages, for the aggregate population of all the countries for which debt figures are available, about \$150 per capita, against approximately \$27 per capita in 1913, and annual interest charges about \$6 per capita at the present time, as against about \$1 per capita in 1913.

PERSONALS



Oscar C. Merrill has been appointed by Secretary of War Baker to the position of executive secretary of the Federal Power Commission. Mr. Merrill, who was formerly chief engineer of the United States Forest Service and had been connected with that service since 1909, is well known on the Pacific Coast as a water power specialist. Mr. Merrill graduated from the Massachusetts Institute of Technology in 1905 and spent his first year out of college at the University of California as an instructor in the college of engineering.

He then became associated with Charles G. Hyde and began his specialization in water-power consulting work by investigating the adaptability of power sites along the line of the Southern Pacific in Oregon and Washington. Later Mr. Merrill made a valuation of the system of the California-Oregon Power Company with Mr. Hyde. In 1909 Mr. Merrill entered the Forest Service and started a survey of the water-power sites of California and in 1910 was made district engineer with headquarters in San Francisco. He was soon placed in charge of all water powers coming under the jurisdiction of the Forest Service and in 1914 was ordered to Washington to become chief engineer of the Forest Service. From his intimate connection with the undeveloped water-power of the West through the Forest Service Mr. Merrill is perhaps better fitted for the position of executive secretary of the Federal Water Power Commission than any other man in the government service. The appointment of Mr. Merrill assures the people of the West that their interests will be looked after by a man who has studied conditions in this part of the country, and who can appreciate what it means to the West to have a law which will allow the development of its greatest natural resource.

W. E. Robertson, of the Robertson Cataract Co., Buffalo, New York, is looking after new business and enjoying a vacation in the Puget Sound district. He arrived in Seattle September 3.

Charles E. Taber, chief clerk for the Southern California Edison Company in Redondo district, has gone to Tampico, Mexico, where he has a position with the International Petroleum Company.

George T. Bradley, superintendent of the Western Colorado Power Company in Telluride, Colorado, has resigned to take a position with the Holly Sugar Company at Delta. He will be succeeded by Harry J. Johnson.

R. T. Stafford, manager of the Seattle offices of the Allis-Chalmers Company, recently enjoyed a four-day vacation in British Columbia, starting Sept. 3 and ending Sept. 7. A major portion of the time was spent in Vancouver.

Carl M. Heintz, of the Los Angeles office of the Westinghouse Electric & Manufacturing Company, has been appointed chairman of the publicity committee which will handle the two Electrical Homes soon to be opened in the southern city.

A. B. Wollaber, district manager for the Southern California Edison Company in Pasadena, is making an extensive trip through the Northwest, where he also attended the convention of the Northwest Section of the National Electric Light Association.

W. S. Berry, of San Francisco, sales manager of the Western Electric Company, arrived in Seattle on Sept. 12. He expects to spend a few weeks in the Northwest enjoying a well-earned vacation and at the same time, looking after certain business matters.

D. W. Proebstel, operating instructor in the Portland Railway Light & Power Company, Portland, Ore., is making an extensive trip through California and will visit a number of the important electric plants in and about Los Angeles and the San Francisco bay region.

F. R. Whittlesey, formerly in the commercial department of the Portland Railway Light & Power Company, Portland, Ore., has been appointed secretary of the Oregon Association of Electrical Contractors and Dealers at Portland, to succeed J. P. Mundt, who has resigned.

Roy Worth, sales manager of the Pacific States Electric Company, Seattle, and **R. H. Husbands**, in charge of the transmission department of the same company, represented the Pacific States Electric Company at the Spokane convention of the Northwest Electric Light & Power Association.

Howard W. Angus, secretary of the California Cooperative Campaign, has been in Los Angeles for the past two weeks. Captain Angus has been looking after the interests of the campaign in Southern California, particularly the opening of the Los Angeles Electrical Home and the proposed industrial lighting exhibit.

D. E. Harris, vice-president and general manager of the Pacific States Electric Company, San Francisco, accompanied by Mrs. Harris, is spending three weeks in the Northwest. The time will be equally divided between Spokane—including attendance at the convention of the Northwest Electric Light & Power Association,—Seattle, and Portland.

H. A. Barre, electrical and mechanical engineer of the Southern California Edison Company, has been promoted to the position of executive engineer with that company.



Mr. Barre is a graduate of the University of California from the college of electrical engineering and since graduating with the class of 1897 has had wide experience in the electrical industry in various parts of the United States. Mr. Barre first went to work with the Southern California Edison Company in 1901 when he was an operator at their Mill Creek

No. 1 plant. In 1906 he went with the Electric Bond and Share Company as associate chief engineer and during this time did a great deal of work in the operation and valuation of the seventeen companies that were under the control of the Electric Bond and Share Company. In 1908 Mr. Barre went to Arizona with R. S. Masson and formed the Electric Construction Company, building a power house on Fossil Creek with a head of sixteen hundred feet. In 1911 Mr. Barre went to work for the Pacific Power & Light Company which has since become a subsidiary of the Southern California Edison Company. Mr. Barre is well known for his work in building high tension long distance transmission lines, the 150,000-volt line of the Southern California Edison Company, extending 240 miles from Big Creek to Los Angeles, being one of his latest accomplishments.

The regulating commissions of the West favor the development of this district and make possible the power development to meet Western needs.

FORWARD WESTERN INDUSTRY!

C. T. Baldwin, trade and markets editor on the staff of *Electrical World*, is at present spending some months on the Pacific Coast in order to become better acquainted with the electrical industry in this region. Mr. Baldwin, who is a graduate in electrical engineering from Princeton University with the class of 1912, was with The United Electric Light & Power Company of New York City until 1917, when he entered the service, from which he was discharged as captain of infantry. Since 1919 he has been with the McGraw-Hill



Company in New York, handling the trade editorial work of *Electrical World*. During his stay in the West Mr. Baldwin will work in cooperation with the *Journal of Electricity*, and will keep closely in touch with electrical activities on this coast.

Milton Kraemer, consulting combustion engineer, has returned to his San Francisco offices after an absence of several weeks in New York City.

Lloyd Henly, engineer, San Joaquin Light & Power Corporation, was in San Francisco recently to attend a meeting of the Committee on Overhead Line Construction.

E. B. Bumsted, a consulting electrical engineer of San Francisco, has returned to his San Francisco offices after an absence for some weeks past in Kansas City and other middle western cities.

J. B. Fullerton, western district manager of the Apex Electrical Distributing Company, is making a trip over his district for the purpose of getting in closer cooperation with the various agencies.

R. V. Reppy, general counsel for the Southern California Edison Company, has returned to Los Angeles from a trip to Washington, D. C., where he attended the conference of the Federal Water Power Commission.

R. E. Cunningham, superintendent of distribution for the Southern California Edison Company, Los Angeles, was in San Francisco recently to attend a committee meeting of the Committee on Overhead Line Construction.

Frederick W. Gay of The William Cramp and Sons' Ship and Engine Building Company, I. P. Morris Department, Philadelphia, is a recent San Francisco visitor. Mr. Gay was formerly located in San Francisco with J. G. White and Company.

Bruce Lloyd, who had charge of concrete ship construction in the West during the war period, has returned to San Francisco after a five months' visit to his old home in New Zealand. Mr. Lloyd is considered an authority on Diesel engine installation aboard ships.

Donald I. Cone, protection engineer for the Pacific Telephone & Telegraph Company, after an absence in the Northwestern states of several weeks' duration in which he has been investigating certain phases of inductive interference, has returned to his San Francisco office.

Wesley G. Carr, head of the patent department, Westinghouse Electric & Manufacturing Company of New York, and Victor S. Beam, legal department of the same company, New York, are in San Francisco at the present time looking after the legal interests of their company.

K. Kita, electrical engineer, Bureau of Electrical Exploitation, Ministry of Communications, Tokyo, Japan, is a visitor in this country as a representative of the government of Japan for the purpose of studying methods of rate fixing, particularly in the case of utilities for the distribution of electrical energy.

Robert Sibley, editor of the *Journal of Electricity*, and Clotilde Grunsky, associate editor, were in attendance at the recent convention of the Northwest Electric Light & Power Association at Spokane. Mr. Sibley gave the address of the convention held jointly with the Spokane Business Association Wednesday noon, September 8, 1920.

C. V. Foulds, chief field engineer of the Pelton Water Wheel Company, and his wife have left for Bombay, India, where he is to be with the Andhra Valley Power Supply Co., Ltd., in the installation of six 15,000-hp. single overhung impulse Pelton turbines. Mr. Foulds expects to be in India for the next year and a half.

Albert Casper, Vallejo Electric Light & Power Company, Vallejo, California, has recently left for a trip to the Northwest to inspect the recent installations of electric ranges in that territory. Mr. Casper has installed a large number of ranges in and around Vallejo and this trip to the Northwest is being made with the idea of finding the latest methods in use there.

L. S. Ready, of the California Railroad Commission, has been appointed chairman of the committee of the San Francisco Section of the American Institute of Electrical Engineers to look into the matter of increasing the service of the Section to its members during the coming year. On this committee are J. P. Jollyman, W. G. Benson, Robert Sibley and C. A. Turner.

W. G. Tanner, of the Los Angeles business office of the Southern California Edison Company, received second prize in the contest just closed for a new name for the National Electric Light Association Bulletin, his suggestion being "The Kilowatt." Mr. Tanner submitted a sketch of a figure called Mr. Kilowatt which will be adopted by the association as an emblem. First prize was awarded to Robert E. Lee of Brooklyn, whose suggestion was "National Electric Progress."

Alexis Germeau and Franz Dupont, electrical construction engineers of Charleroi, Belgium, and Maurice Henriod, engineer of the export department of the Ohio Brass Company, Paris, France, are making a tour of the Pacific Coast states. These engineers have been inspecting the high tension transmission lines of the West and the methods used in railway electrification. The party came over the Chicago, Milwaukee & St. Paul Railroad to Seattle and from there down the Pacific Coast to Los Angeles, from which point they will return East by way of Denver.

R. H. Ballard, vice-president and general manager of the Southern California Edison Company, George A. Campbell, general manager Truckee General Electric Company, S. M. Kennedy, vice-president Southern California Edison Company, Glenn D. Smith, general manager of the Ontario Power Company, A. B. West, vice-president and general manager of the Southern Sierras Power Company, and A. Emory Wishon, assistant general manager of the San Joaquin Light & Power Corporation, were recently in San Francisco attending the meeting of the Public Relations Committee, Pacific Coast Geographic Division of the National Electric Light Association.

Henry G. Symonds, Westinghouse Electric & Manufacturing Company, Chicago, has been awarded one of the war memorial scholarships of that company. These scholarships were established in 1919 by the Westinghouse Company as a means of perpetuating the memory of those employees of the company who took part in the Great War. Each scholarship carries with it the annual payment of \$500 for a period not to exceed four years and this payment is to be applied toward an engineering education in a technical school or college selected by the candidate and approved by the scholarship committee. Mr. Symonds has selected Leland Stanford Junior University, Palo Alto, California, as the place where he will complete his education in electrical engineering.

Meeting Notices for Electrical Men

(With the close of the summer vacation period electrical organizations are starting in vigorously on their year's work. Recent reports include elections of officers and important meetings of the Illuminating Engineering Society, the Seattle A. I. E. E. and the Contractor-Dealers' state executive committee.—The Editor.)

Bay Cities Chapter, Illuminating Engineering Society

A special meeting of the Bay Cities Chapter of the Illuminating Engineering Society was held in the rooms of the Engineers' Club in San Francisco, during the recent convention of the National Traffic Officers' Association, in honor of Dr. Clayton H. Sharp. Dr. Sharp is technical director of the Electric Testing Laboratory in New York and was present at the convention to assist in the framing of a suitable headlight law.

At the meeting Dr. Sharp spoke on "Some Accomplishments of the Illuminating Engineering Society" and traced the history of the society from the time of its organization in 1906 until the present time.

At the time the society was formed the first tungsten lamps had just appeared and sounded the death knell of the old carbon lamps. This meant more and better illumination, and while at first the illuminating engineers paid attention to obtaining a narrow direct ray of light by means of a reflector, the science has now progressed to such a point that the reflectors are turned upside down.

In speaking of glare Dr. Sharp said that the importance of eliminating this phase of lighting was just beginning to be realized, and that while at first only Holograph glass was known, at the present time there were so many varieties that it was possible to secure good illumination without glare in many different ways. In illuminating engineering the United States has always been far in advance of Europe, according to Dr. Sharp, but England has made great strides since the war and is now doing constructive work.

The question of controlling the headlights on automobiles is one of the most difficult problems that the illuminating engineer has to solve. In the first place, the question is extremely complicated on account of the factors that enter into the case, for one must of necessity have a small, intense light controlled so that it will send a long narrow beam down a dark road without glare and without sending its rays into the path of the oncoming machines. This problem is being solved and the fact that the American Automobile Association had called upon the Illuminating Engineering Society to frame a model law controlling headlights shows that the value of the work done by the society is being recognized outside of the electrical industry.

In closing his address Dr. Sharp told of the problems that must be solved in the lighting of industrial plants. "We have proven," said Dr. Sharp, "that increased lighting in an industrial plant will increase production to such an extent

that better lighting is a very profitable investment. The problem now to be solved is to what point illumination shall be raised to be the most efficient."

Timber Preservation Discussed at San Francisco Engineers' Luncheon

The proper use and conservation of timber in the United States was discussed in a very interesting way before the Engineers' Club of San Francisco on September 1 by Dr. Hermann Von Schrenk, consulting timber engineer for several railway lines throughout the country.

Dr. Von Schrenk laid great emphasis upon the need for real engineering thought in the use or non-use of preservatives for cross-ties, transmission poles, piling, etc., and linked up this phase with the practice in European countries, where he has studied the situation closely. There it is realized that even with reforestation recurring periodically, a great amount of thought is devoted to the preserving of the timber in hand. In view of the fact that the accessible timber supply in the United States is not inexhaustible without reforestation, the speaker strongly urged that real attention be paid to conserving timber in every possible way.

Convention of Western States Reclamation Association Outlines Plans

The convention of the Western States Reclamation Association, which was held at Boise, Idaho, August 20 and 21, was marked by constructive work and definite plans toward the securing of interest in reclamation throughout the West, and the passage of satisfactory reclamation legislation at the short session of Congress to be held in December. The Western states were well represented.

The report of the publicity committee provides for communication with the leaders of the political parties, with traffic officials of the transcontinental railroads, for the organization of a speaking campaign through chambers of commerce, Rotary clubs and other organizations, appointment of a permanent political committee of three, and company cooperation with the American Legion, real estate associations and other organizations of national scope.

R. S. Shepherd, of Jocum, Idaho, was appointed permanent chairman of the finance committee, and was authorized to raise \$30,000 to carry on the association's work. Judge

The West has a very high purchasing power—the market for manufactured products is a good one.

FORWARD WESTERN INDUSTRY!

BUILDERS OF THE WEST—LXXXV



FREDERICK LAIST

No more potent influence has exerted itself in the West in the upbuilding of industry than the production of copper. Continual and steady research activities examining new and hidden processes of electro-chemical production have ever exerted a wholesome and stirring influence in industry. To Frederick Laist, manager of the great Anaconda smelter of the Anaconda Copper Mining Company, Anaconda, Montana, this issue of the Journal of Electricity is affectionately dedicated in appreciation of his ideals of research in the production of copper, particularly in electro-metallurgical developments, that have been so preeminently helpful in the upbuilding of the industry in the West.

The West has a very high purchasing power—the market for manufactured products is a good one.

Will R. Ring, former counsel for the Reclamation Service, E. F. Blaine of Seattle, Sims Ely of Arizona, and H. V. Platt, vice-president and general manager of the Oregon Short Line Railroad, were among the speakers. At the close of the meeting the following resolution was adopted:

"Resolved, That it is the purpose of the Western States Reclamation Association that at the approaching session of Congress the efforts of this association should be concentrated on securing from Congress, either by direct appropriation or by the extension of the credit of the government, as provided in the Smith-Fletcher bill, ample funds to prosecute the reclamation of lands now unproductive by reason of aridity or excess of moisture within the United States, each reclamation to be carried on and funds expended through extending agents of the government, and that preference in securing homes upon such lands be given to former service men and women of the world war."

Seattle Section, A. I. E. E.

The Seattle Section of the A. I. E. E., according to Willis T. Batcheller, secretary, is rapidly rounding into an organization which is a credit to any city. The membership is steadily climbing. Since the first of 1920, approximately forty new members have been added to the Section's roster.

Considerable interest is being evinced in the programs for the Fall meetings of the Section and this interest is well warranted. At the October meeting, to be held on the 19th, H. J. Gille, general sales manager, Puget Sound Power & Light Company, is scheduled to address the assemblage on "Engineering and Contingencies—15%"; on November 16th, at the third Fall meeting, J. D. Ross, superintendent, Seattle Municipal Lighting Department, will deliver a paper on "An Experimental Demonstration of Radiation," and on December 21st, the last meeting of the quarter, F. G. Simpson, vice-president and general manager, Kilbourne & Clark Manufacturing Company, Seattle, will talk on "Recent Developments in Radio Engineering."

Mr. Simpson, during the period of the war, ranked as a Commander in the U. S. Navy and did notable work in supervising naval communications along the Atlantic Coast. Therefore, what he says on radio matters will be noted with exceptionally keen interest.

Mr. Ross's paper will consist of an experimental demonstration of radiation from Hertzian rays to Gamma rays, with special reference to Maxwell's electromagnetic theory of light and the structure of matter. In connection with his paper, Mr. Ross will present several new experiments.

According to present indications, the Annual Dinner of the Seattle Section of the A. I. E. E., to be held at the Butler Hotel on Sept. 21, will be a notable affair. Arrangements for the program are being made as rapidly as possible and final announcements are expected at an early date. It is believed that practically a complete membership will be in attendance to hear Willis T. Batcheller, secretary of the Seattle Section of the A. I. E. E., make his report on the National Convention held at White Sulphur Springs, West Virginia, June 29 to July 2, inclusive, to which he was a delegate. At the dinner also G. E. Quinan, chief engineer of the Puget Sound Power & Light Company, will report on the Pacific Coast Convention, held in Portland July 21-24, inclusive.

California Association of Contractors and Dealers Meets at San Diego

At the session of the state executive committee, on Aug. 13, letters were read from various power companies on the purchase of power company bonds by contractor-dealers, and authority was given to buy 500 posters in connection with the purchase of these bonds. This is just one more step in getting the confidence of the trade in back of the distributing companies.

The executive committee adopted a recommendation to the members that the state association meetings be held in July, October, January and April, and that these quarterly meetings alternate between northern and southern California, covering a two-day period. The question of the association

adopting a standard estimate was considered, but it was left to individual action, inasmuch as opinion indicated that members desired to use forms meeting their own requirements.

Varying time limits extended on payments for washing machines, as well as size of initial payments, were discussed on the fourteenth at the retail session; the general impression left was that time payments should be reduced to six months and that \$15.00 was not too large an amount for an initial payment. A committee will report on this at the next executive meeting.

On the same day at the members' meeting it was moved that the state executive committee meet with R. L. Eltringham of the Industrial Accident Commission, on his request, on Sept. 18, at Paso Robles. Merchandising was discussed and Imperial Valley and San Diego members favored the electrical home for their localities.

Montana Contractors and Dealers Meet to Further the Industry

"Promoting the electrical industry in Montana" was the purpose of the convention of the Electrical Contractors and Dealers' Association of Montana, meeting in Great Falls on August 22 and 23. There was no lack of harmony and spirit of cooperation, and a standard of work was adopted and a decision reached to confine its business to the state. From the growth of the organization, it is expected to comprise 95 per cent of electrical contractors and dealers of Montana before the next meeting in Butte in March, 1921.

Trips of inspection were made to large industrial and hydroelectric properties, and special efforts put forward to have the dinners as attractive as possible.

San Francisco Section A. I. E. E. Elects Officers for Coming Year

At a recent meeting of the Executive Committee the officers of the San Francisco Section A. I. E. E. for the year 1920-21 were chosen, as follows: Chairman, J. P. Jollyman, engineer electrical construction, Pacific Gas & Electric Company; vice-chairman, W. B. L'Hommedieu, manager of power division, Westinghouse Electric & Manufacturing Company; chairman, membership committee, J. J. Reed, telephone engineer, Pacific Telephone & Telegraph Company; chairman of the papers committee, W. B. L'Hommedieu, manager of power division, Westinghouse Electric & Manufacturing Company; secretary, Allen G. Jones, General Electric Company, San Francisco.

Wood Preservers and Tie Producers to Meet in San Francisco in January

San Francisco is to be the seat of two conventions of timber men next January. The American Wood Preservers' Association has set the date of Jan. 25, 26 and 27 for their seventeenth annual meeting, after convening with the engineers of Southern California in Los Angeles on the twenty-fourth, and the National Association of Railroad Tie Producers convenes on Jan. 27 and 28 for its third annual meeting.

San Francisco Engineers Hear Talk on Concrete

H. C. Boyden was the speaker after the luncheon at the Engineers' Club in San Francisco on Sept. 8. His topic was "Recent Developments in Concrete," dealing with the molecular formation resulting from the setting of the materials.

BEGINNING

in the October first issue Miss Virginia Fairfax, librarian with the Carnation Milk Products Company, Chicago, will contribute to the Journal of Electricity a series of articles on the handling of PAMPHLETS AND CLIPPINGS IN THE BUSINESS LIBRARY

HAPPENINGS IN THE INDUSTRY

RESTRICTIONS ON NON-ESSENTIAL LIGHTING ISSUED IN CALIFORNIA

Following rather closely upon the heels of the California Railroad Commission's order No. 113 of Aug. 30, published in these columns of Sept. 1, H. G. Butler, Power Administrator, issued order No. 115 on Aug. 30, curtailing the use of electricity for non-essential purposes. The order was effective at once and will remain in force until Oct. 1. Unless the water situation is relieved before that time, however, it is probable that the order will be extended another month.

Order No. 115, directed to all northern and central California power companies, and to mayors of communities in those areas, reads as follows:

(1) Effective at once until Oct. 1, 1920, except Saturdays and Sundays, no electrical energy shall be furnished or used—

- (a) For advertisements, notices, announcements or signs designating the locations of an office or place of business, or the nature of any business.
- (b) For external illumination for ornamentation of any building.
- (c) For lights in the interior of stores, offices or other places of business when such stores are not open for business.
- (d) For excessive street lighting intended for display or advertising purposes.

2. This order shall not be construed to prohibit the furnishing or using of electricity for sign lights as may be required by law or public safety.

"Unless there is the fullest kind of cooperation in our efforts to protect the essential industries of this section of the state," said Mr. Butler in discussing the serious power situation caused by the scanty rainfall of the last three years, "great damage will be done. Growing crops must be protected and the wheels of essential industries must be kept moving. Each user of electricity for sign purposes should realize that the burning of an electric sign is now an advertisement of the fact that he is using electricity which should go to the productive industries of his community. Many are now out of work because of the power shortage. The unemployment is bound to increase if waste continues.

"Public opinion is correct in assuming that this non-essential use of electricity should be restricted in favor of productive enterprises," said Mr. Butler. "In many of the smaller communities of the state, splendid cooperation has been given. The larger cities, apparently, have not had the seriousness of the situation brought home to them. It is now a case of conserve or suffer."

In closing his letter to the mayors Mr. Butler says: "May we have the help and cooperation of your public officials and police force in securing prompt compliance with this order, as we did in 1918 when a similar order was in effect."

General compliance with this order is reported throughout the regions named, although there are some noticeable exceptions. The Retail Drygoods Association of San Francisco, for instance, has proposed full cooperation, and in the windows of many of the large stores the following sign has been placed:

In order to save power for productive industries and growing crops, our electric signs and windows will be kept in darkness in accordance with the order of H. G. Butler, State Power Administrator.

Police in several cities are assisting in enforcing the order on delinquent consumers, and certain power companies announce their intention of cutting off current from those violating the order.

A further order, No. 117, was issued on Sept. 4, part of which follows:

Arrangements have been made between the office of the Power Administrator and representatives of the Irrigation Division of the United States Department of Agriculture and of the College of Agriculture of the University of California, who have consented to assist during the present emergency, by which the power available for agriculture can be handled to better advantage.

As far as possible, agricultural power must be used between the hours of 9 p.m. and 7 a.m.

The order suggests that power companies consult local representatives of the Irrigation Division in regard to the carrying out of the section modifying paragraphs 1 and 2 of Order No. 113, printed on page 243 of the Sept. 1 issue of the Journal of Electricity. This prohibited the use of electricity for irrigating orchards after the crops had been removed. The new order prevents permanent damage to the orchards and at the same time prevents any excessive use of power.

IDAHO POWER COMPANY TO BUILD NEW HIGH TENSION LINE

A new 132,000-volt line from its Thousand Spring plant to Caldwell is now being located by the Idaho Power Company. It is understood that construction work will begin as soon as material arrives, with July, 1921, set as a date of operation. Sixty-foot wood towers will be used. The financing was through the recent sale of \$2,000,000 of 8 per cent first and general lien bonds.

COURT ANNULS COMMISSION'S ORDER ON PASADENA TO FILE RATES

California's Supreme Court has recently declared annulled the order of the Railroad Commission of the State of California requiring the city of Pasadena, a municipal corporation, to file a schedule of rates for electric service. It was as the result of an application for certiorari to review the Commission's order that the decision was rendered. The court found "No tenable ground upon which to base the conclusion that the rates charged by a municipality for its service in carrying on any public utility, either within its own limits or in outside territory, are under the control of the Railroad Commission."

The city of Pasadena supplies electric service in the adjoining city of South Pasadena also, and it was on complaint of the Southern California Edison Company, through the Pacific Light & Power Company, which also supplies electric service to the inhabitants of South Pasadena, that the order was issued a year ago.

It is probable that the Railroad Commission will not consider an appeal to higher authorities until after a decision has been rendered by the United States Supreme Court in a similar case now pending, involving the Public Utilities Commission of Illinois.

SAN FRANCISCO MINT INSTALLS ELECTRIC FURNACE

To increase the output of minor coins, the United States Mint at San Francisco is installing a Rennerfelt electric furnace of 1000 pounds capacity, operating on two-phase, 60-cycle service transformed from 2200 volts to 110 volts. The furnace was originally in operation at the Philadelphia (Pa.) Mint, and was only recently withdrawn from service there when replaced by furnaces of more recent design and greater capacity. It is hoped to have the furnace in operation by the end of September, but this may be delayed through uncertain delivery of certain electrical switching equipment.

The labor supply of the West is reasonable and adequate in comparison with other districts.

FORWARD WESTERN INDUSTRY!

Only metal for pennies and nickels will be melted in this furnace, silver being handled in the oil-fired crucibles now in use. Several of these crucibles were taken out to make room for the electric furnace, while considerable construction work was necessary to accommodate the new equipment. A motor-driven topping machine and a motor grinder will be installed to handle the clipping and smoothing of the ingots, and a mechanical conveyor will eliminate most of the heavy carrying of the molds now done manually.

NEW POWER PLANT AT BEND, OREGON

In preparation for the construction of the first unit of the Bend Water, Light & Power Company's plant on the Tumalo River, plans for which are now in the hands of the state engineer, a crew of men was sent out to build the necessary roads and to put up bunk houses for the large force to follow.

Plans for the first unit call for a 300-ft. fall, which it is estimated will cost \$100,000 and will develop 2,000 hp. The second unit, which will not be built until demands warrant its construction, will utilize the water going through the first plant, with a fall of 400 ft., in a 12,000-ft. pipe line. This unit will develop 3,000 hp. and will cost approximately \$150,000.

WESTERN STATES FILE SIXTEEN APPLICATIONS FOR WATER POWER

Under the new federal water-power act, sixteen applications for preliminary permits or licenses have been reported by the Federal Power Commission at Washington. These preliminary permits are merely for the purpose of maintaining priority of application for license under terms of the act for a period of not exceeding three years, while examination and survey for preparing the necessary maps, specifications, estimates and financial arrangements are under way.

It is interesting to note that of the thirty-eight applications so far made public by the federal commission, sixteen are in the San Francisco district, district No. 5, which comprises the states of Washington, Oregon, California, Nevada, Arizona, Idaho and parts of Montana, Wyoming and Utah. The greater parts of Montana, Wyoming and Utah are in district No. 4, the Denver district, the remainder of which takes in Colorado and parts of New Mexico, Nebraska, South Dakota and North Dakota. In this district there have been no applications made public to date. Of the twenty-two remaining applications, twelve have been filed in New York state, principally along the Niagara and St. Lawrence rivers.

Among the Western states, the greatest activity is indicated in Washington, where six applications have been filed. Idaho has filed four, California three and Oregon, Montana and Arizona one each. The one in the southern part of California is on the Colorado River, which is bounded by Arizona at that point, which is filed also under Arizona.

OBJECTIONS PRESENTED AT CALIFORNIA BOILER CODE HEARINGS

At the public hearings on the tentative revised boiler safety orders for California, which have been held in San Francisco, objections have been raised by those interested in boiler operation to some of the revisions proposed by the committee appointed by the Industrial Accident Commission of California. A further hearing has been scheduled for October 7 in San Francisco, to continue where that of August 19 left off.

For new installations, the commission is at present following the 1914 boiler code of The American Society of Mechanical Engineers, and it proposes to adopt that society's 1918 code to bring matters up to date.

The rub comes principally on the proposed code as applied to existing installations. Objections have been filed on the rules that shall apply to calculating the safe working pressure of staybolted surfaces (378, b) and on factors of safety for lap-riveted construction. It is objected that a factor of safety of $4\frac{1}{2}$ should be set as a minimum and let it apply to a boiler regardless of its age, making it higher if conditions of the boiler called for it. Sec. 380 (a) proposes from $4\frac{1}{4}$ to 5 for boilers ranging up to 20 years old, where lap-riveting is employed and the shells are exposed to the direct products of combustion. Where the shells are not so exposed, the Commission proposes a factor of from 4 to 5 for the same range and objectors have recommended the same figure of $4\frac{1}{2}$.

A further factor of safety of six is objected to as too high in the case of second-hand stationary lap-seam boilers within the state on October 1, 1920, where both ownership and location have changed (Sec. 381, a). It is expected that other objections will be submitted at the October 7 hearing.

The personnel of the boiler revision committee is quite representative of the interests concerned with boiler operation, and takes its members from gas and electric power stations, electric railways, machinery dealers' associations, lumber associations, insurance companies, oil companies, operating engineers' unions, the Industrial Accident Commission, iron works, merchants and manufacturers' associations, and a board of public works.

SAN JOAQUIN LIGHT & POWER CORPORATION START NEW PLANT

Right on the heels of the starting of the new Kerckhoff power house comes the announcement from the San Joaquin Light & Power Corporation's construction department that ground has been broken for the new natural gas-burning steam plant in Kern county, one mile east of Buttonwillow.

According to General Superintendent E. A. Quinn, of the power company, who has this work in charge, the new plant will be rushed to completion to meet the heavy demand next summer. All machinery for the first unit, consisting of a battery of tubular boilers, a steam turbine and an Allis-

APPLICATIONS FILED FOR WESTERN WATER POWER PERMITS

State	Applicant	Address of Applicant	Location of Project
Arizona.....	C. A. Heberlein.....	Prescott, Arizona.....	Cataract Canyon, Coconino County, Ariz.
California.....	Pit River Power Co.....	San Francisco, Cal.....	Pit River, California.
California.....	R. W. Hawley.....	833 Market St., San Francisco.....	Silver Creek and branches, Eldorado County, Cal.
California.....	Beckman & Linden Corp.....		Colorado River in Arizona and California.
Idaho.....	G. W. Sperry.....	Bonnors Ferry, Idaho.....	Moyie Falls on Moyie River, Idaho.
Idaho.....	Utah Power & Light Co.....	Augusta, Me.	Soda Point, Lava, Narrows and Mink power sites on Bear River, Idaho.
Idaho.....	Idaho Power Co.....	Boise, Idaho.....	Upper Salmon Falls on Snake River, Idaho.
Idaho.....	Idaho Power Co.....	Boise, Idaho.....	Twin Falls on Snake River, Idaho.
Montana.....	Rocky Mountain Power Co.....	Butte, Mont.....	Flathead River below outlet of Flathead Lake.
Oregon.....	Crown Willamette Paper Co.....	Pittock Block, Portland, Ore.....	Falls of Willamette River, West Linn, Ore.
Washington.....	Washington Irrigation & Development Co.....	905 White Bldg., Seattle.....	Priest Rapids, Columbia River, Wash.
Washington.....	Alex. Polson.....	Montesano, Wash.....	Headwaters of Wynooche River, Olympic National Forest, and north-eastern part of Gray's Harbor, Wash.
Washington.....	Northwestern Pwr. & Mfg. Co.....	Donworth, Todd & Higgins, Hoge Bldg., Seattle.....	Lake Crescent, Elwha River, Wash.
Washington.....	Hugh L. Cooper.....	101 Park Ave., New York.....	Clark Fork of Columbia River, Wash.
Washington.....	Sound Power Co.....	25 Broad St., New York.....	Sultan River and Olney Creek, Snohomish County, Wash.
Washington.....	Straits Power Co.....	25 Broad St., New York.....	Soldue River, Crescent Lake and Lyre River, Clallam County, Wash.

Chalmers generator of 17,500-horsepower capacity, has been ordered from the manufacturers and will begin to arrive as soon as the steel and concrete power house building is completed, which is scheduled for December 15. It is expected that this new plant will be in operation by next April.

To Occupy 120 Acres —

The site for the new gas-burning steam plant is located on the county highway and on the McKittrick branch of the Southern Pacific, 28 miles from Bakersfield, and consists of 120 acres. It will provide ample room for a spur track, a battery of three 18-inch wells 500 feet deep, outdoor transformer stations and other necessary electrical equipment. Comfort conveniences will be provided, notable of which will be an ice plant and a swimming pool 190 by 290 feet.

Largest in the World —

Five units are planned for this plant, which, when completed, will be the largest natural gas-burning steam plant in the world. The gas consumed will measure 7,000,000 cubic feet per day for each unit and will come from the famous Elk Hills gasser, nine miles south, under a well pressure of from 250 to 400 pounds per square inch. The capacity of the gas plant is 50,000,000 cubic feet a day.

Big Saving of Fuel Oil —

Using natural gas instead of fuel oil for steam generating purposes represents a saving of from 1100 to 1200 barrels of oil a day for each unit.

A transmission line of 110,000 volts with a capacity of 30,000 kilowatts will connect with the Kerckhoff power line at the Corcoran substation. Another line will connect with the McKittrick substation from which will be served the West Side oil fields districts of Kern county.

To Cost \$5,750,000 —

The cost of the plant will be \$1,750,000 for the first unit and \$1,250,000 for each additional unit. P. D. Dawson is the designing engineer and C. P. Rhine is resident engineer. J. L. Black is general foreman.

NEW RADIO STATION AT PORTLAND

The Federal Telegraph Company will construct a 100-kw. radio transmitting station of the Poulsen Arc type in the vicinity of Portland in the near future.

This station is being constructed primarily to handle the company's business between Portland and San Francisco, but is of sufficient capacity to be used in trans-Pacific work.

A 620-foot steel antenna tower will be constructed and transmitting power will be supplied by two 100-hp. motor generator sets, driven by synchronous motors.

The station will be erected about 20 miles from the heart of the city, but will be operated by remote control from the company's main office in the Board of Trade Building. The new set will give the company three duplex circuits which will transmit and receive three messages simultaneously.

Mr. F. H. Barstow is Portland manager of the Federal Telegraph Company, and will have charge of the operation of the new station.

SOUTHERN CALIFORNIA EDISON BOND ISSUE AUTHORIZED

The Railroad Commission of California on Aug. 30 authorized the Southern California Edison Company to issue on or before Dec. 31, 1920, \$438,000 face value of its general and refunding mortgage 6 per cent 25-year gold bonds of the series of 1919. The bonds or the proceeds are to be used to pay or refund bonds issued by the Edison Electric Company of Los Angeles, the issue having been made necessary by the recent sale by the Southern California Edison of certain of its electric holdings to the city of Pasadena.

ANOTHER ELECTRICAL HOME OPENED

The third Electrical Home in California was opened in Oakland on August 26th with some fifty invited guests at the pleasant ceremony. Mr. Gregory of the East Bay Electrical Trades Association presided at the meeting, which was

A Booklet describing in detail The Modern Home Electrical is in course of publication. You, no doubt, will wish a copy so kindly fill out this card plainly and leave it in the box in the garage.

Name _____

Address _____

City _____

Most of those who attended the exhibit at the Oakland Electrical Home wished to receive the booklet which the East Bay Trades Association is issuing and in consequence left their names and address. Not only does this provide a proper follow-up of the electrical idea, but a record of attendance is thus obtained in the most advantageous way.

addressed by Robert Sibley, editor of the Journal of Electricity, as well as by a representative of the Oakland Chamber of commerce. A program of music in which an electrically operated piano played an important part completed the exercises.

The Electrical Home had been well advertised and by ten o'clock in the morning automobiles and foot passengers began to arrive in numbers. Especially effective provision has been made for bringing people to the house. Large red arrows direct those interested from all parts of town and conductors on street cars running to the district are instructed with the necessary information for their passengers.

The house is well designed and attractively outfitted, both in the furnishings and the electrical equipment. The convenience outlet is particularly well featured, there being some sixty outlets in the various rooms of the home.

Great interest has been shown both by the press and the public at large and it is expected that the success of the previous Electrical Homes will be duplicated.

N. E. L. A. WATER POWER COMMITTEE ACTING WITH FEDERAL COMMITTEE

Franklin T. Griffith, president of the Portland Railway Light & Power Company, Portland, Ore., and chairman of the committee on water power development of the National Electric Light Association, has just returned from Washington, D. C., with Guy W. Talbot, president of the Pacific Power & Light Company, Portland, Ore., where they attended a conference with the federal water power commission.

This commission, composed of the Secretary of the Interior, the Secretary of War and the Secretary of Agriculture, was created by act of Congress in the early part of the summer, to formulate rules and regulations under which permits and licenses for water power development may be issued.

These rules and regulations determine the terms and conditions under which federal lands may be occupied, the character and extent of development to be made, the charges of the government for permits and also for the use of federal lands, the time within which development shall be completed,

Seventy per cent of the nation's water powers are located west of the Rocky Mountains. Power development awaits the demand for it.

FORWARD WESTERN INDUSTRY!

the use to which the power shall be put and also many questions involving accounting, operation and finance.

On the assumption that the water power committee of the N. E. L. A. could be of assistance in offering suggestions as to the practical workings of rules and regulations, the federal power commission summoned the committee to Washington, where the members have been in conference for the past several weeks with the federal water power commission and its executive staff.

There is an apparent disposition on the part of the federal water power commission to make the Act really workable, with full safeguards for the national interests, and to provide a system of development and operation that will at once afford the best and cheapest service to the public. Combined with this is the desire for such stability of investment in water power developments as will enable the companies to make such developments and obtain the necessary money at reasonable rates, because of the assurance of return and security.

STAND-BY CHARGE IN RECLAMATION SERVICE PROPOSED IN CALIFORNIA

In connection with the schedule of rates for electricity sold to reclamation districts, an order was issued on Aug. 30 by the Railroad Commission of the state of California, designed to cover variable conditions resultant from the use of energy by the different districts. According to the Commission, its effect will be to place all districts on an equal footing so far as rates are concerned and to require them to pay a stand-by charge. The Commission holds that reclamation service is primarily an insurance service, the average consumption per horsepower per year being very low.

ELECTRIC DREADNAUGHT WINS ECONOMY TRIALS

Final proof of the practicability and surpassing efficiency of the new type electrically-driven dreadnaught was given by marine engineers and naval authorities when Admiral Hugh Rodman, commander-in-chief of the Pacific fleet, was notified by dispatch from the Navy Department that the New Mexico, the only dreadnaught propelled by an electric motor, had won the economy steaming test in competition with all major ships of the United States Navy.

The dreadnaught New Mexico, now on the Pacific Coast, is propelled by turbine generators which supply electrical energy to motors directly connected with propeller shafts.

N. E. L. A. ADVANCED ACCOUNTING COURSE

In order to introduce thoroughly throughout member companies its advanced accounting course, the National Electric Light Association has reduced the price thereof from \$65 to \$40.

It is expected that a great many of the member companies will take advantage of this opportunity to establish classes in advanced accounting. This course consists of thirty-six lessons and follows carefully the best practices of progressive light and power companies.

The price of the elementary accounting course remains the same as formerly, the complete course costing \$16, and groups of ten or more sent in at one time \$14 per course. For the benefit of the industry as a whole the association last year removed all the restrictions as to enrolment in these courses, and they are now open to all those who may apply at the regular association prices.

CONSTRUCTION UNDER WAY ON EXTENSIVE PIT RIVER POWER PROJECT

The Mt. Shasta Power Corporation, whose stock is owned by the Pacific Gas & Electric Company, has applied to the California Railroad Commission for a certificate declaring that public convenience and necessity require the development by the company of the Pit River project in Northern California. This application was heard on Sept. 2 and the case was taken under submission. John A. Britton, general manager of the company, recently told the commission that his company has plans for hydroelectric power developments to cost a total of about \$125,000,000, divided equally between power plants and distributing systems.

The chain of developments in the Pit River region is to be carried out first. This work will involve seven plants, of which four are to be constructed now and the remainder as may be necessary.

Work started in July on two of the first four plants. These are known as Hat Creek No. 1 and No. 2 and they are to be finished by January 1, 1921. These require no storage and only small diversion weirs will be used for diverting the flow. No. 1 will have 2400 ft. of canal and 1750 ft. of penstock, developing 9300 hp. on a 215-ft. head. No. 2, with a 4750-ft. flume and a 400-ft. penstock, is to develop 12,300 hp. on a head of 195 ft.

The next two plants, Fall Creek No. 1 and No. 2, are just being started. They are to be completed in August, 1921. No. 1 requires 10,000 ft. of 14-ft. tunnel, from which a short penstock will develop a 430-ft. head, giving 60,000 hp. No. 2 will take the tailrace water from No. 1 via a flume line to a point farther downstream, when a drop of 100 ft. can be utilized to develop 18,000 hp. This makes a total of 99,000 hp. to be available by next fall from these four plants, all grouped closely together.

The three other plants, not to be constructed just yet, are all farther down on Pit River, and are to be known as Pit River Plants No. 1, No. 2, and No. 4. No. 3 is an alternate plant not now being considered. No. 1 will have a 100-ft. dam and a tunnel line, developing 72,000 hp. on a 300-ft. head. No. 2 is to take tailrace water from No. 1 and after traversing a tunnel, develop 42,000 hp. on a 185-ft. head. No. 4 is to take the No. 2 tailrace water and after traversing a 7-mile tunnel, 20 ft. in diameter, develop a head of 932 ft. in a plant where the installed capacity is to be 232,000 hp. If present plans are to be carried out, the latter plant would have water turbines of record size. The units would be single runner vertical shaft type rated between 60,000 and 75,000 hp.

In all seven of these plants the water wheels are to be of the same type—vertical, single-runner units. The flow in the Pit basin is remarkably uniform; the seasonal variation on Hat Creek at No. 1, for example, does not exceed the range of 450 to 600 sec.-ft. At first the 60,000-volt transmission line of the California-Oregon Power Company is to be used to deliver the power from these plants, but later on a two-circuit, 220,000-volt line is to be built all the way to San Francisco.

WASHINGTON STATE FILES POWER SITE TO PROTECT PRIORITY RIGHTS

What is believed by members of the Reclamation Board of the state of Washington to be the first instance on record of a state filing on a power site, is the action of that board in notifying the federal power commission of its purpose to take steps to protect its priority rights to a power site at Five Mile Rapids on the Snake River in that state. The board has expended over \$10,000 in investigating the site which, it declares, will be most serviceable if developed in irrigating 60,000 acres of land in Franklin and 40,000 acres in Walla Walla county.

WANTED—Copies of November 15, 1919, issue of Journal of Electricity. Twenty-five cents will be paid for each copy sent to this office.

TRADE NOTES

Motor Company Opens Western Offices —

The Electro Dynamic Company of Bayonne, New Jersey, are opening offices in San Francisco, Los Angeles, Portland and Seattle. The business on the Pacific Coast and in Arizona and Nevada will be under the supervision of Coast Equipment Company, L. A. Somers, managing director. The Coast Equipment Company has arranged for Messrs. Conway and McCalley to handle their business in Oregon. Offices will be maintained in the Lewis Building, Portland.

New Manager of Utah Company —

John J. Crowe, for the past year sales manager for the Intermountain Electric Company, has resigned to become general manager of the Utah Electric & Motor Equipment Company.

Previous to his connection with the Intermountain Electric Company, Mr. Crowe was for six years a machinery salesman with the Salt Lake Hardware Company. Before that he was for five years purchasing agent with the Capital Electric Company of this city.

The Utah Electric & Motor Equipment Company is one of the most completely equipped retail stores in the Intermountain west for the sale of electrical appliances, supplies and equipment and automobile accessories and supplies.

The floor space occupied by this Company was recently doubled in size, and other changes have been effected which provide complete facilities for serving the company's large trade.

Change in Sales Department —

The St. Louis Electrical Works of St. Louis announce that they have added to their staff Mr. J. F. Jones as sales manager. J. C. Grindell, former Seattle manager of this company, is now in St. Louis in the sales department. After conditions improve so that they can again make deliveries in better shape, Mr. Grindell will go back to Seattle.

Western Distributors —

The Estate Stove Company have recently established connections with distributors who cover western territory as follows: Listenwaller & Gough, Inc., Los Angeles, Cal., distributors for lower California and Arizona; Alexander and Lavenson Electric Supply Company, San Francisco, distributors for upper California and Nevada, and North Coast Electric Company, Seattle, Portland and Tacoma, distributors for Alaska, Washington, Oregon and northern Idaho.

Book and Bulletins

Engineers Unite

The last word on the much discussed organization of The Federated American Engineering Societies is given in a pamphlet which has been published and contributed by the McGraw-Hill Company, Inc., as an expression of its interest in this forward movement among engineers. The pamphlet consists of reprints of news articles and editorials from the pages of the publications of the societies and the engineering and industrial journals.

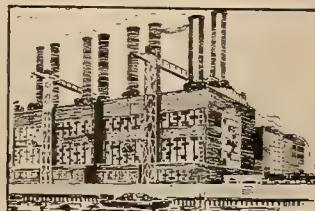
Because the editor of each journal saw the recent Conference at Washington through his own eyes, and with reference to the particular field of engineering which his paper covers, the interpretative editorials in this pamphlet taken from the different journals, as well as the news stories, give a cross section of the Organizing Conference, which perhaps could not be obtained in any other manner.

Novalux Ornamental Street Lighting Units

"A well dressed city, like a well dressed man, commands attention and respect," is the keynote sentence to the beautiful street lighting booklet which has been published by the General Electric Company. Illustrations of the many artistically designed lighting units fill the first part of the booklet while the latter part contains views of city streets now using these units.

Proposed Super-Power Central Station

An unusually fascinating booklet is the result of reprints of the articles by John A. Stevens which appeared in



The sketch of the proposed super-power central station. This appeared as the cover illustration of the recent booklet which presents the subject with all its fascinating details.

the May 25 and June 1, 1920, issues of "Power." Mr. Stevens is a consulting engineer for power plant construction with offices in Lowell, Massachusetts.

This booklet sets forth in an interesting manner and with the aid of charts and diagrams, the proposed design of a super-power station built with multiples of

30,000-kw. units up to a total capacity of 100,000, 300,000 or even 500,000 kw. Each unit consists of four 1,716-hp. boilers, normal rating, served by one stack centrally located, and supplying steam to one 30,000-kw. turbine.

It is planned that all boiler houses will be separated from their turbine rooms by an explosion gap, and the turbine rooms are separated by explosion walls.

The reader feels that he is getting a glimpse well into the future when he goes on to read of the main operating room which is to be located at the top of this super-structure, together with sleeping quarters for the men, baths and showers, telephones, searchlight, alarm whistles and wireless apparatus.

Self-Supporting Chimneys to Withstand Earthquake

An article under this title, by C. R. Weymouth, chief engineer, Charles C. Moore & Company, appears in the March issue of Mechanical Engineering, the journal of the American Society of Mechanical Engineers.

This article is noteworthy because of its discussion of the nature of stresses on chimneys developed by seismic shocks, because of its presentation of the theory of design of chimneys to withstand such stresses and because of the particulars which it gives regarding chimneys in which this theory has been applied.

The author summarizes the studies of the Japanese Imperial Investigation Committee on the nature of the stresses developed in chimneys in consequence of earthquakes and further examines the conclusions of this committee in the light of data on chimney failures which has been secured from inspection of the wrecks caused from the San Francisco earthquake in 1906.

An advancement to the theory which has been developed by Professor Omori, chairman of the Japanese committee, on the design of chimneys to withstand earthquakes, is presented. This new theory assumes that the chimney should not be looked upon as rigid but rather as a body oscillating about the center of percussion. The various chimneys where this theory has been applied are referred to.

The cost of electricity to the consumer is lower in the West than in any other district of the country.

FORWARD WESTERN INDUSTRY!

NEW ELECTRICAL DEVELOPMENT

(The Northwest is actively promoting the financial interest necessary for the carrying out of its new construction work. In the Pacific Central District improvements in water supply constitute an important question; also in the Southwest, where new pumping installations and irrigation developments are reported. New plans for extensive water storage are featured in the Inter-Mountain news.—The Editor.)

THE PACIFIC NORTHWEST

BEND, ORE.—The plans for the first unit of the Bend Water, Light & Power Company, on Tumalo, are now in the hands of the state engineer and the plant will be in shape for business by the latter part of 1921.

SALEM, ORE.—Ninety-one permits for the appropriation of water from Oregon streams, the irrigation of 3,129 acres of land, and three permits for the construction of reservoirs were issued by the state engineer during the months of June and July.

MARSHFIELD, ORE.—Work on the new United States Navy wireless station to be erected on the north side of Coos Bay is to be rushed. This station is to be operated entirely independent of the present government wireless station now in operation in Marshfield, and is designed for the express purpose of assisting mariners when they lose their bearings.

SEATTLE, WASH.—A moving picture theater of fireproof construction which will rival most of the Northwest's finest show houses will be erected at once. The architecture will be of the modern Italian Renaissance type and attractive flower gardens are included in the plans of the architect. A complete heating and ventilating plant is to be installed. It is stated that the seating capacity will be 1400 persons.

SALEM, ORE.—A direct appropriation of \$250,000 on government credit in an equal amount under what is known as the Smith-Fletcher bill now pending before Congress will be sought by the executive committee of the Western States Reclamation Association, which met in Salt Lake City recently, according to Percy Cupper, state engineer, who attended the conference.

SALEM, ORE.—Application has recently been filed with the state engineer requesting state guarantee of interest on bonds in the sum of approximately \$250,000 voted by the Talent irrigation district. The district has authorized bonds amounting to more than \$600,000, but only \$250,000 of the securities have been sold. The application will come up at the next meeting of the irrigation securities commission.

SCIO, ORE.—Work is being pushed on the new \$40,000 municipal electric plant. A large dam is being constructed to hold the waters of Thomas Creek, the water to be carried one mile through a flume having a fall of 68 feet and developing 326 hp. at the lowest stage of the water. The power generated will be transmitted to Scio and there used to supply the light and power needs of the city and to operate the water plant.

SEATTLE, WASH.—The completion by the city architect of plans and specifications for the new Cedar Falls power house designed to accommodate the necessary machinery to develop 20,000 additional horsepower marks the last step preparatory to beginning actual construction work on this much needed unit, figured to cost \$1,000,000. Plans will be presented to the board of public works for approval and inasmuch as the board members have been kept fully advised as to progress being made on the plans, the approval of this body is expected.

SALEM, ORE.—An extensive development of power on the south fork of the Coquille river is contemplated by M. J. Anderson, of Portland, and his application for a permit to appropriate

the water has been filed with the state engineer. The construction of a reservoir for the storage of 18,700 acre-feet of water and a tunnel and a pipe line about three miles long for the appropriation of 75 second-feet of water under a head of 1556 feet, which will develop 13,000 theoretical horsepower, are contemplated. The cost of the development is estimated at \$750,000.

PORTLAND, ORE.—Charles B. Hall of Prosser, Wash., was a Portland visitor for the purpose of bringing to the attention of the Portland Chamber of Commerce plans for development of a big irrigation project in the Horse Heaven district of Washington. The appropriation of water for the system is from the flow of the Klickitat river on its headwaters near Mount Adams, and would be conveyed to the land by a main canal 125 miles long. The estimated cost for the entire project is more than \$18,000,000, which it is proposed to raise through the sale of municipal irrigation district bonds.

THE PACIFIC CENTRAL DISTRICT

MANTECA, CAL.—The Manteca water works has just completed another well which will enable the installation of additional machinery for the water system in Manteca.

SANTA CRUZ, CAL.—The corporate name of the Boulder Creek Electric Light and Water Company having been changed to Santa Cruz County Utilities the Railroad Commission, in a supplemental order, changes its recent order permitting the company to issue bonds and stocks so as to convey the authority to the Santa Cruz County Utilities.

COLUSA, CAL.—Owners of 9000 acres of land across the river from Colusa have completed the dredging of a drainage ditch as far as the Sacramento river, and the dredge is now making its way back to the north end of the ditch, where a two-mile lateral will be dug. The project was established by the Colusa Delta Farms and other owners on the east side.

SANTA CRUZ, CAL.—An option has been taken on 16 acres of ground for a reservoir site near Bay Street, on the brow of Escalona Heights. The cost of preparing a reservoir for water and building a dam will be \$50,000. The proposed reservoir will impound 12,000,000 gallons of water. A quarter of a mile of pipe will have to be laid, to connect with Majors Creek.

VALLEJO, CAL.—The city council of Vallejo took the final step prior to the calling of a bond election for \$1,250,000 to finance the Gordon Valley water project as a future water supply of this city, when it instructed City Engineer T. D. Kilkenny to prepare final plans and cost estimates for the purchase of the necessary rights-of-way and construction of the system.

SACRAMENTO, CAL.—Sealed bids will be received up to 11 a.m. Sept. 30 for furnishing transformers, sluice gates, centrifugal pumps, induction motors, intake and pumping works, electric crane for pumping and filtration works. Bids must be on forms from H. J. Desmond, clerk. A certified check for 10 per cent is required. Separate bids will be received on various segregated parts of the work.

SAN FRANCISCO, CAL.—A convention of radio manufacturers, the initial conference of its kind on this coast, will be held in San Francisco in the latter part of October, it was an-

nounced by the San Francisco Radio Club. The three-days' session will open with an address over a radio telephone to the convention hall. The instrument will be installed by the De Forest Radio Telephone and Telegraph Company, under the supervision of R. M. Klein.

OROVILLE, CAL.—Directors of Honcut Yuba irrigation district have adopted a plan to take care of 30,000 acres. The plans will now go to State Engineer McClure. Later, a bond election will be called. The total cost will be \$1,780,636. The flumes will be of metal and the syphons and weirs of reinforced concrete. A hydraulic filled dam is recommended for Virginia ranch reservoir. The pumping station is designed for a capacity of 300 second-feet.

WILLOWS, CAL.—A committee appointed jointly by the Chamber of Commerce and the board of trustees to inquire into the adequacy of the present water supply has asked the town trustees to employ an engineer to place a physical valuation on the water plant of the Pacific Gas & Electric Company with a view of acquiring it as a basis for a municipal water plant.

CORCORAN, CAL.—Sealed bids will be received until 10 a.m. September 18 for construction of canals, ditches, etc., in the Corcoran irrigation district.

STOCKTON, CAL.—Issuance of bonds to the amount of \$3,004,396 for a municipal water supply system and flood protection for Stockton is recommended in a report submitted to the city council by Fred H. Tibbetts, consulting engineer retained by the city to investigate sources of water supply for the city of Stockton. The report covers a survey of the Calaveras flood control project and embodies as an appendix a previous report by Tibbetts on the water system of the Pacific Gas & Electric Company, which supplies Stockton.

BAY POINT, CAL.—The Bay Point Light & Power Company was given an increase in rates for electric service approximating 25 per cent by the Railroad Commission on Aug. 24. In its application for an increase in rates, the company requested the Commission to allow it to charge the same rates that the Great Western Power Company and the Pacific Gas & Electric Company charge in adjacent territory. The applicant purchases current from the Great Western Power Company and operates a distributing system in the towns of Bay Point and Clyde and adjacent territory, serving in excess of 400 consumers. The gross operating revenue increased from 7,540 in 1917 to 919,223 in 1919, during which time many new industries located at Bay Point, among them being the Pacific Coast Shipbuilding Company. Fixed capital increased from 28,955 to 638,961 in the same time. It is estimated by the Bay Point Company that the increased power charges for 1920 would approximate \$3,000, due to the 15 per cent surcharge that the Commission granted the Great Western Power Company on July 10. The order of the Commission states that it finds the existing rates of the company unjust, unreasonable and inadequate so far as they differ from rates and surcharges hereafter to be charged, which the Commission finds to be just and reasonable rates. Besides bringing the regular rates up to the same as charged by the larger companies, a surcharge of 15 per cent is to be added. This surcharge is to be in effect until May 24, 1921.

THE PACIFIC SOUTHWEST

LA VERNE, CAL.—Hanawalt Bros. have been awarded the contract for building the reservoir at Monrovia, at \$17,500, also the contract for the construction of the reservoir at Arcadia.

ST. JOHNS, ARIZ.—Contracts for about 15 miles of canal extension work for the Lyman Water Company have been let to local parties for approximately \$112,000. There were many bidders on the work, which was divided into sections.

PHOENIX, ARIZ.—City Manager Thompson has placed before the city council a proposal for the popular election to authorize \$1,000,000 in bonds for improvements and extensions of water, fire, sewer and park systems, and additions to the city hall, new jail, and paving.

ARLINGTON, CAL.—Work has been commenced by the Twin Buttes Water Company on laying a pipe line from West Riverside canal to carry 300 inches of irrigating water to La Sierra Heights section. This is the first unit of the \$60,000 irrigation system to be added to the Twin Buttes holdings.

SANTA ANA, CAL.—C. E. Treat, president and manager of the T & W Manufacturing Co., is laying plans for the construction of a factory in Los Angeles to cost about \$35,000. The site has not as yet been decided upon. Treat is the inventor of an adjustable electric plug known as the T & W Universal Plug. His company is incorporated and capitalized for \$150,000.

RIVERSIDE, CAL.—Engineer Lee Nafzgar has submitted tentative plans for the installation of a pumping plant to supply water for Rubidoux reservoir at a minimum cost of \$57,671, which provides for the installation of a first-class plant of two units, with two turbine pumps capable of developing 300 inches, and for the laying of 10-in. pipe to the reservoir at Mt. Rubidoux.

LOS ANGELES, CAL.—A survey of dam sites and canal lines, planned in the big scheme of harnessing the mountain floods of the Colorado river to provide water for irrigation of more than 2,000,000 acres of land, has actually commenced, as announced by W. W. Schlecht, who is managing the survey of the U. S. Reclamation Service. Mr. Schlecht has left for Boulder Canyon reservoir site to undertake preparations for this engineering feat.

LOS ANGELES, CAL.—The directors of Van Nuys board of trade have conferred with the Supervisors and an agreement has been reached whereby the location of the Hutchins Dam in Paroima Canyon was moved to the Narrows, about two miles below the Hutchins farm. In the bond issue for flood control, \$359,000 was provided for dam construction. The dam at the new location will be 350 ft. high and 500 ft. across the top, and will impound 9,800 acre-ft. of water.

LOS ANGELES, CAL.—Ross Construction Company of Sacramento and Los Angeles was the only bidder, at a total of about \$81,224.80, for constructing the Live Oak Canyon concrete dam about three miles northeast of LaVerne for the Los Angeles County Flood Control District. The dam as planned is to be a simple arch type about 260 ft. long on top, 86 ft. high above bedrock, 47 ft. thick at base and 6 ft. thick at top. It will have a 20-ft. wide spillway and 36-in. pipe sluiceway, and will impound about 350 acre-ft. of water.

LOS ANGELES, CAL.—An order by the Railroad Commission authorizes the Southern California Edison Company to issue, on or before December 31, 1920, \$438,000 face value of its general and refunding mortgage 6 per cent 25-year gold bonds of the series of 1919. The bonds or the proceeds are to be used to pay or refund bonds issued by the Edison Electric Company of Los Angeles, the issue having been made necessary by the recent sale by the Southern California Edison of certain of its electric holdings to the city of Pasadena.

OWENSMOUTH, CAL.—An extension of the Pacific Electric line from Owensmouth to Chatsworth is contemplated.

THE INTER-MOUNTAIN DISTRICT

RUPERT, IDA.—The light and power system has been cut over to a new connection at the transformers and substation. The delta connection now in use does away with grounded wires and is more efficient than the former distributing system.

LOGAN, UTAH.—Plans are under way for the drainage of 100,000 acres of land between Wellsville, Cache county, and the northern boundary of the state of Utah, according to R. A. Hart, in charge of the western federal drainage investigations.

DELTA, UTAH.—The Deseret Power Company has filed articles of incorporation with the secretary of state of Utah. Its capital is \$200,000, divided into shares of \$1 each. H. G. Maxfield is president; Marcus Skeen, vice-president; E. W. Jeffery, secretary and treasurer.

MILES CITY, MONT.—A \$500,000 corporation to irrigate 75,000 acres of land between Glendive and Forsyth, and deal in land and generate power for general purposes, but especially for carrying out the irrigation plan, is being promoted by the Yellowstone Irrigation Company.

EUREKA, UTAH.—The North Standard Mining Company is installing a new electric motor, which is much larger than the one formerly in use, and which will be large enough to carry the shaft down to any depth. Just as soon as this new motor is installed, the operation of sinking the shaft will be pushed rapidly.

LOGAN, UTAH.—The irrigation and drainage department of the Utah Agricultural College is enlarging its facilities. A new laboratory will be put into use for the first time this fall, which is designed to study soil and water in relation to irrigation projects, with special attention paid to the rate of movement of water through soils of different textures.

OGDEN, UTAH.—Fifteen canning factories of northern Utah, practically all of which are operated electrically, have started operations for the fall canning season. About twenty other plants, located in other parts of the state, have also completed plans for opening their fall season of operations, and will all begin operations during the early part of September.

BRIGHAM, UTAH.—Brigham City has voted a \$200,000 bond issue for the rebuilding and enlarging of the municipal power plant in Boxelder Canyon, at a special election held August 31st. The present capacity of the municipal plant is between 300 and 400 horsepower. It will be increased to 100 horsepower. Work will begin on the plant as soon as the bonds are sold.

BOISE, IDA.—Jensen and Von Herberg, owners of moving picture theaters in Oregon, Washington, Idaho and Montana, and the Independent Booking Company are investigating the possibilities of establishing a moving picture theater at Boise to cost approximately \$600,000. The plans for the proposed theater call for a modern and entirely new type of moving picture theater construction.

MALAD, IDA.—A case that will be watched with interest by the people of Idaho has just been filed with the public utilities commission of Idaho. The Nez Perce Telephone Company of this place alleges that the Grangerville Electric Company has constructed five miles of electric lines parallel to the telephone company's line, and in such proximity as to render the telephone company's lines worthless on account of inductive interference. The telephone company asks the commission to order the removal of the electric power line.

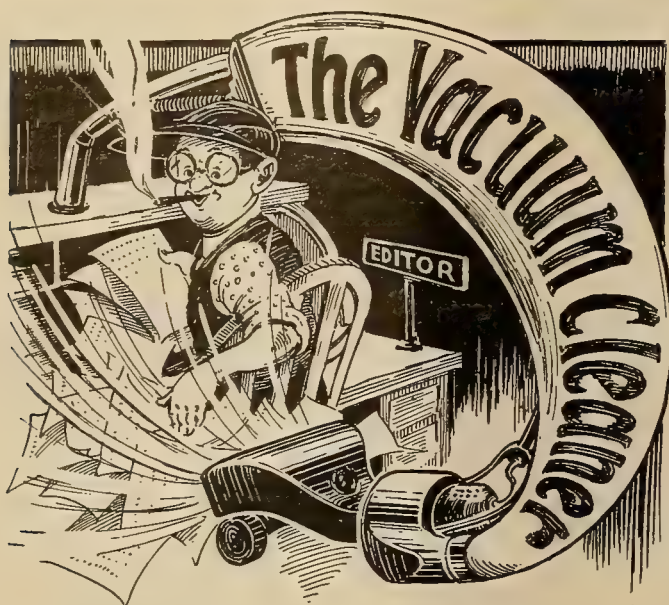
SALT LAKE CITY, UTAH.—Upon his return from the League of the Southwest conference in Denver recently, Governor Simon Bamberger told of a plan outlined by Arthur Powell Davis, director general of the United States Reclama-

tion Service, which comprehends the building of a dam in Boulder canyon where an immense quantity of water can be stored. This would cost about \$20,000,000 and would be the largest dam in the world. Its capacity would be 240,000,000 acre-feet of water. It would take care of 10,000,000 acre-ft. of silt which are annually brought down the Colorado. The storing of such immense quantities of water would develop great water-power energy, that near Green river producing about 290,000 horsepower. This in a few years, according to Mr. Davis, would become more important than the water impounded. It was estimated that the Colorado produces 2,666,000 horsepower, now unused.

PROVO, UTAH.—Preliminary plans have been launched for the formation of a new irrigation district in Utah county, and according to the declaration of those back of the project, a large area of fertile land will be made available for agricultural purposes. The project is to be known as the Santaquin irrigation district, and it is proposed to secure the required water supply from the Strawberry Valley project and Summit Creek. A petition has been prepared to Governor Bamberger, requesting him to petition the county commissioners of Utah county to list the land to be included in the district, and to make required land and water allotments. In the event of favorable action by the commissioners of Utah county on the petition to be submitted by Governor Bamberger, an accurate survey of the district will be made and the proposition will be referred to the voters of the district for approval.

BOISE, IDA.—The government has entered into a contract with the Emmett irrigation district whereby the district can build a diversion dam at a point known as the Black canyon of the Payette river, six miles northeast of Emmett. The closing of this deal is a matter of great importance, not only to the Emmett district, but also to Boise, Caldwell, Nampa and every town in the Boise valley, as well as eastern Oregon. It is the first important step taken by the government toward the development of the Black canyon irrigation district, comprising 90,000 acres of land. The proposed dam will be 90 feet high, 300 feet long and have a 700-ft. spillway. In the contract entered into the government reserves the right to use the dam to divert water from the Payette river to the district at any time either by the government or the Black canyon district or by both. The government agrees to pay its proportionate share of the cost of construction. Half of the land in the district can be irrigated by pumping and half by gravity.

POCATELLO, IDA.—The most important irrigation venture is being talked of at Hailey. Diversion of the waters of Alturas lake and upper Salmon river into Big Wood river to assure a more steady supply for irrigation purposes is discussed. The work is being backed by the Idaho Development and Exploitation Company. The company proposes to construct a dam across the lower end of Alturas lake, thereby utilizing one of the largest natural reservoirs in the country. This water will not be needed until the last of July, 1921. From Alturas lake the company plans to construct a canal to the Salmon river, picking up the waters of smaller creeks on the way. When this canal reaches Salmon river it is planned to tunnel straight through the mountain and empty the water out into the headwaters of Wood river. Should this plan be perfected large reservoirs will be installed at intervals along the river to store the supply until it is needed. The construction of such a system of supply will prove to be a great asset to the country dependent upon Wood river for its supply, and the majority of the people in that section are in sympathy with the movement. No further steps will be taken in the project until a report is received from the engineers who are investigating it.



Apropos of some bright discoveries about misleading terms that we published a short time ago, someone else has got delirious on the subject and contributes the following:

"Monkey-wrenches are neither made by or of monkeys, and ottar of roses is not extracted from the otter. Poles are not made by pole-cats or badges by the badger.

"A lathe chuck is a contrivance fixed to the mandrel to hold the wood—it is not a wood-chuck. A wood-chuck is a ground-hog, which is not a hog and is not ground—ground hog is sausage. And a lathe mandrel is not a monkey, though a mandrill is.

"Angel-food is eaten by everybody. There are no sponges in sponge-cake, and the eating of lady-fingers does not imply cannibalism any more than taking a buggy ride implies what it might if everyone were always literal.

"Chicken-pox has nothing to do with chickens, neither has egg-plant—nor a cocktail.

"A horse-chestnut is as far removed from horses as a saw-horse, clothes-horse, or a horse-radish. A horse-chestnut is a nut, so is the thing that goes with a bolt, so is a doughnut.

"Sweetbreads are neither sweet nor bread.

"Walnuts grow on trees, not on walls.

"Chess-men are not men. There is no soda in soda-water. Wax-beans are not wax. Highballs do not roll about, and biographies are not written by biographs.

"Catgut is no more feline than pussy-willow, or cat-tails, and fire-dogs are andirons and are made frequently of brass, and a copper is a policeman or a bull, but an Irish policeman is not an Irish bull.

"Whiffle-trees, boot-trees, hall-trees and family trees are as out of place in the woods as a railway-frog, a fish-plate, a fish story, a mackerel sky or a crabapple in the water."

Personally, we think this has gone far enough. We've reached the stage where we spend all our spare time thinking of things like this.

* * *

Lucidity always appeals to us, which accounts for our reproducing the following from the San Francisco Chronicle,—part of a letter inspired by an article on sun spots:—

Permit me also to refer to the moon rays, noctuary invisible to the naked eye, on account of the supreme volatileness of their illtipicity. These rays also greatly influence the nocturnal evolution of the earth and its fructification after it returns to its epi-zoroastric revolutions or normal position. The elligation of the surface of the earth is of a quasi non-perceptible displacement on account of the continual cosmogony deviation of its axis during the daylight period, the moon's cerestonic rays at night correct this. The moon reacts or counter-balances the elucidal attraction or drawing power of the sun during the day, for she retaliates, if I may use the expression, upon the effects of the attributal sun power or upon the effects of the zoroastric nebula, engendered through the variegated sunbeams, occasioned by the sun spots. The moon is of super influence and shows this through a thorough study of its transluence course. Excuse this rather dry explanation, but the initiated will clearly comprehend.

The only way to get rid of temptation is to yield to it, said some one who had evidently attended summer sales. Anyone who has ever bought two tooth brushes because they were fifty cents each and two for ninety-five cents will appreciate the following plaintive ballad by a victim of the bargain habit.

A SONG OF SUMMER SALES

There's a crowd of people giving
Hints about the cost of living,
There's advice on sandwich boards and office doors;
There's a car card that implores you
To invest the cash that bores you
And "the Joy of Clipping Coupons will be yours."

But though everything is double
And a dollar's but a bubble,
And I'm swamped with pamphlets advertising thrift,
While the summer sales are calling
I'm continually falling
At the counters where the bargain-hunters drift.

I've bought presents for my cousins,
And engagement gifts by dozens
For the couples who have just been introduced;
I've bought towels and nutmeg graters
And electric percolators
And anything that's ten-per-cent reduced.

When the summer sales are ended
And my final dime's expended
And the stores display their 'newest autumn line'
A thrift stamp I shall borrow
To dispel my summer sorrow,
And the Joy of Clipping Coupons will be mine.

* * *

The H. C. L. does not seem to be affecting some people. The other day we saw a newspaper heading which read:

"\$3600 SUIT IN MOTOR CYCLE ACCIDENT"

We don't pay that for our dress suit even now, and if we did we should use an old one for motor cycling.

* * *

A discussion on home lighting was recently reported in part as follows:

One of the members spoke of the air of coziness given to a room by a portable lamp and added, "I have in mind a room of about 16 by 40 which was used by three people. With ceiling lights turned on, we were lost in the place. If we wanted to play cards in the corner we used a wall bracket and portable standard. One other interesting point for convenience, all of the wall switches instead of being inside the room were outside the room and on the same side of the door as the door knob. If you went into the bathroom, you turned on the light before you went in. This scheme worked out very satisfactorily."

That is all very nice with the exception of the location of the switches. Evidently the speaker is an only child, but as for us we have a small brother who long ago discovered the infinite possibilities of a switch located outside a bathroom door, when the bather within has just lost the soap.

* * *

Unnecessary frankness seems to characterize some modern advertising. A recent export advertisement in a trade paper reads:

"CEYLON SKINS AND HIDES"

If we did that we'd keep it dark.

* * *

A new item has been added to the Ancient Compilation of Useless Statistics. We read that "the streets of Greater New York, if extended in one continuous line, would reach almost across the American continent." Some day we are planning to get out a book of useless statistics, but there are still a number of items lacking in our data. We should like to know how many matches placed end to end would reach from here to Mars; how many times around the earth the world's supply of shoe laces would reach; how many thumb tacks could be made of the metal in a battleship, and how long it would take the average mackerel to swim from the North to the South pole. If anyone has already worked these out—and from all indications it is highly probable—we should be extremely glad to have them for our collection.

THIS ISSUE: New Electrical Advances in the Northwest

JOURNAL OF ELECTRICITY

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Vol. 45, No. 7

SAN FRANCISCO, OCTOBER 1, 1920

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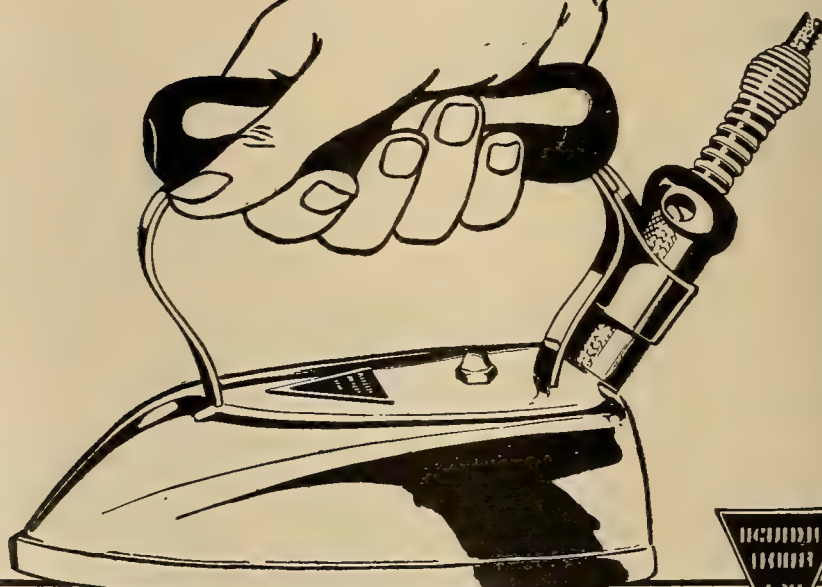
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JOURNAL OF ELECTRICITY

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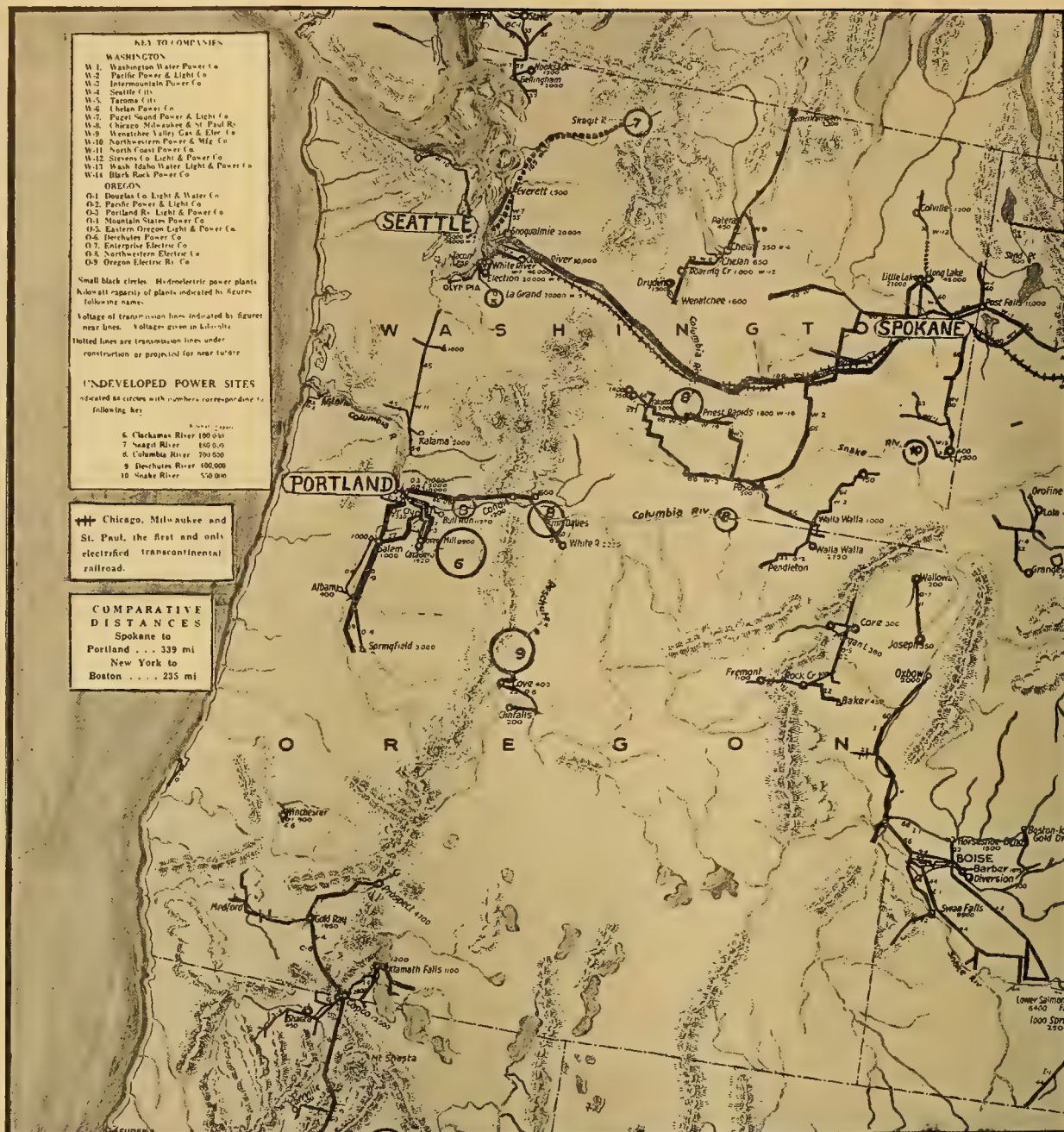
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THE ELECTRICAL TRIO:

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The Great Northwest Visualizes a New Adventure in Co-operation

The fact that the three commonwealths of California, Oregon and Washington hold within their boundaries practically 50 per cent of the undeveloped water powers of the nation lends added significance to the recent activities at the Spokane Convention of the Northwest Electric Light and Power Association, where central station men, contractor dealers, jobbers and manufacturers unanimously decided to establish a Cooperative League in Washington and Oregon similar to that now in operation in California. The power lines that traverse this vast district of our nation as shown above; the adventure and daring evinced in the accomplishment of the first trans-continental steam railroad electrification; and the industrial activity indicated by the fact that 25 per cent of the lumber production of the nation to-day comes from these two commonwealths, lead us to the conviction that once again the electrical industry is about to chronicle new and important advances in co-operative achievement.



JOURNAL OF ELECTRICITY



DEVOTED TO THE UPBUILDING OF THE ELECTRICAL INDUSTRY IN THE WEST
AND IN THE COUNTRIES BORDERING THE GREAT PACIFIC

Volume 45

SAN FRANCISCO, OCTOBER 1, 1920

Number 7

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A CALL *for the* PRINCIPALS

THE public utility has been proud to proclaim its position as a public servant. In the intricacies of rate regulation and the issuing of securities in financing, the public utility commission nominally represents the public and adjudicates between the public and the utility. This is only an artificial distinction, however. With every action governed by public supervision and its entire existence predicated upon the degree to which it meets public needs, the public utility is as essentially a servant of the public as the commission itself.

With this broad definition and program of service, it is essential that all branches of power company activity stand out in the open with every opportunity for public inspection, welcoming publicity as public officials should welcome it who are responsible to the voters of the community. In general, this policy has been recognized by the power companies of the West and relations between these utilities and their respective districts are those of mutual respect. There is, however, one step farther to go. It is time that the financial interests which control the business affairs of public utility companies should stand forward with the same frankness as the managerial department.

The public is an investor in public utility securities; it is beginning to recognize that its welfare is dependent upon these electrical servants of its industry—and it is far from indifferent as to who shall have the direction of these elements in its

prosperity. The directorate of public utility companies have too often stood in the background, holding meetings and determining policies behind closed doors and asking for public interest only when they have something to gain. The spirit in which the electrical industry is meeting the public today is on the whole one of the most broad-minded public service—a fact which is rightly its best guarantee of public favor and of permanent prosperity. The time has come to recognize that the director of a public utility should be not merely a good business man—he should be a man of broad public viewpoint, a fit exponent of the fundamental policies of his industry.

Let the shoe pinch where it may. The Journal of Electricity is proud to boast of utility activity throughout the West as of the highest order. Institute activities, N. E. L. A. organizations, and associations designed to promote service to the public need constantly that stimulus which encouragement at meetings by the presence of the principals themselves can alone give. Certain chief executives and a few of the directorate of these utilities have through untiring effort made the West stand out today as foremost in the nation in activities of this nature. The results speak for themselves.

But where are the others? The public in its day of reckoning will take cognizance of this status of affairs, as surely as it takes all other factors into account in its appraisal of its public utilities and their service.

While there have been in the past conventions of the Northwest Electric Light and Power Association more largely attended, a more lavish outlay of entertainment and perhaps a more brilliant array of central station

The Northwest Association

talent represented on the program, it is, nevertheless, unquestionably true that the work of the Thirteenth Annual Convention of the Association in session during the past semi-monthly period at Spokane, Washington, will go down in history as one of the greatest accomplishments in the eventful years of the Association's history. Not only were technical problems of highest value to the industry in the Northwest brought out in papers and discussions; not only was the message of the industry presented in concise, tabulated form on charts to members present at the sessions, and carried in public lectures to the citizens of Spokane; but, more important than any other feature, the decision was made

by this convention to undertake a Cooperative Campaign similar to the one now in such successful operation in California, on a basis that precludes any possibility of doubt in the hearts of its supporters as to its ultimate outcome and triumphant success.

Unquestionably this definite action taken by the Northwest Electric Light and Power Association setting in motion the cooperative movement which is to be known as the Northwest Electrical League is the most important step to be recorded by the electrical industry of the West in recent months. The action is well considered, coming as the result of a year's investigation, and is unanimously supported by contractor-dealers, jobbers, manufacturers and

J. B. FISKEN, consulting engineer, Washington Water Power Company —

"The clouds which have obscured the electrical industry during the past year have most of them a silver lining and the silver lining is beginning to show."

—Northwest Electric Light and Power Association.

power men alike. The new campaign is inaugurated at a time when the need for power company financing, as well as a growing interest on the part of the public in electrical comforts, make a concerted appeal for a better relationship between the customer and the electrical industry most timely.

The committee in presenting this plan have taken a stand for "merchandising at a profit" both on the part of the power company as well as the contractor-dealer. They stand for strengthening the contractor-dealer association by bringing in all retail elements and for a reciprocal plan of education which shall put new constructive ideas into immediate practice. As a result of these progressive policies, it is expected that the income to all branches of the industry will be definitely increased at the same time that the public is better served. In addition, the new league will act as the legislative and political guardian of electrical interests, and more than all else it will bring about a mutual understanding and serve as the practical expression of a fixed policy toward high standards in inter-industry relationships as well as toward the public.

The actual formation of a permanent committee and the details of financing are in the hands of the new executive committee of the Northwest Association, but the unanimous support already pledged by all branches concerned makes this merely a matter of detail in organization. The Northwest Electrical Service League is already in action.

Electricity is seldom thought of as a by-product, but in the mines and mills of Arizona and New Mexico this is the fact. A large amount of the power generated in these states comes from utilizing the waste heat from the reverberatory furnaces used to reduce the low grade ores of that district. These huge furnaces are fired by Mexican oil or powdered coal, and the exhaust gases are passed through Stirling boilers and the steam used to drive turbo-generators. The electricity is then used in all stages of mining and milling the ore, from driving the air compressors which feed the drills to furnishing the power for the ore cars which carry away the pure metal. This economy has made possible the mining of lower grade ore than before which has increased the output of the district and added to its wealth.

The public generally, ignorant of electricity and its laws, is more or less hesitant in adopting new and unused electrical things. Inherently a sense of fear prevails in the human mind regarding uses of electricity, and any appeal that is made to the sense of fear has a tendency to undo many good things that the electrical industry has been endeavoring to put over during recent years—namely, that of showing to the public the sane, safe and helpful influence that proper installations bring about rather than the awful disaster that may result should installations be improperly made.

The Journal of Electricity and its readers have long been upholders of safety devices and proper uses of electricity in the home, in agriculture and in industry; but we do believe that the utilization of electrical appliances and other devices of a safe character can be brought about without frightening the public into action through fear. Hence, we discountenance any advertising or any publicity matter that endeavors to drive its point home by leading its readers to take action through fear.

The Federal Electric Railway Commission is to be congratulated upon the far-sightedness of the report which was recently made to President Wilson. The salient point of this report was that the street railways should serve the public at cost and be allowed a fixed return on their investment, the value of which should be determined by agreement. This plan of the Commission simply means that rides shall be furnished to the public at the lowest possible actual cost while the investor shall be guaranteed a fixed return on his holdings. When the given fare is found to produce profit above a fair return, the money should go neither to the company nor to the city, but be deflected back to the pockets of the public by an automatic reduction in the fare paid by the rider. Such a plan is palpably fair to both the public and to the investor, and has been used successfully in the operation of the street railroads in several of the larger cities of this country. This plan, if adopted, will make an investment in a public utility operating a street railroad system as safe as a savings bank with probably a slightly larger rate of interest being returned. Some such sweeping change as recommended by the Commission is what is needed to save this branch of the electrical industry from the bankruptcy and chaos which it faces today.

The occasional wide divergence of bids on electrical wiring jobs is one of the elements which contributes most strongly to a distrust of the electrical contracting business. The electrical contractor, on the other hand, fairly contends that this confusion is not altogether, nor even largely, his fault. Plans made by architects and owners, unschooled in the technique of electricity, are usually inaccurate and unclear, and there is often so much confusion that a flat sum is sometimes frankly added to cover the item of misunderstandings. On this basis there can be no standardization.

The advisability of the electrical contractors and the mechanical and electrical engineers getting together in local sections throughout the West to consider the proper drawing up of wiring specifications was advocated in an editorial in the July 15th issue of the Journal of Electricity. Since that time a committee has been appointed by the California Association of Electrical Contractors and Dealers to

cooperate with the engineers along these lines and it remains now only for the local sections of the engineering societies to take similar action.

No action can, of course, be forced upon the public, but it is equally true that no step forward will be taken until a united industry has determined its course. The electrical contractors have taken a most constructive stand in advocating this measure and this opportunity for cooperation in the bettering of standards should not be overlooked by the engineers. It is to be hoped that the formation of engineering committees to consider this subject will be one of the first acts of the fall term.

The various conventions of the leading engineering societies of the country which have been held in different parts of the country within the past month have given an opportunity of presenting the proposition of a joint engineering organization to the main bodies of these societies. The reaction in the main has been favorable, definite action being taken in one or two cases and in others the question presented to the absent members for a written ballot.

In general, the balloting has disclosed the fact that the conservative element which is present in almost all organizations and which regrets any step beyond the purely technical interests of the engineer, is not widespread and that as a whole the membership of these societies is in favor of the broader viewpoint.

No selfishly narrow considerations should be permitted to stand in the way of this cooperative effort between engineers. As a matter of fact, no rights are subtracted from any one of the joining organizations and the new body's function is merely to add a means for influencing those elements in the lives of engineers and in public relationships in which the entire engineering profession has a common interest. At a time when the question of engineering compensation is competing in public interest with the compensation of all lines of workers, when the question of the licensing of engineers, already a fact in eleven states, is coming up this year again for consideration in several others, and when public matters of vital importance are demanding the expert advice which the engineering profession has to give, this movement for a coordinated stand of all engineers is of the utmost timeliness. Every other profession has its medium for united expression—the engineering group can no longer afford to lessen its influence by scattering its energies.

The question of the factor of safety to be used in determining safe working pressures for boilers other than those built to comply with the A. S. M. E. code and which have been for some years in operation, has been one fraught with considerable discussion in recent weeks in the West. It seems that the Boiler Revision Com-

mittee of the Industrial Accident Commission of California, holding hearings in San Francisco, proposes a factor of safety increasing with the actual use of the boiler. Some serious objections have been made to these factors by users of boilers and by second-hand dealers. It would appear evident that an increasing factor should be applied from year to year in proportion to the length of service of the boiler, and it is to be hoped that the objections will be cleared away in a friendly manner and the entire code put into operation at the earliest date possible, in order that this commonwealth may stand in its usual position, that of front rank in matters of progress towards safety and accident prevention.

Lap-seam construction has come in for the greatest amount of discussion. The attitude of the committee appears to be fair to the owners of lap-seam boilers within the state of California in that it proposes no change in safety factor on existing installations from those in force since Jan. 1, 1917. These boilers were purchased and installed in good faith, under the conditions of safety then generally known. But the committee seems to be unwilling to permit a prospective purchaser to buy and change the location of a lap-seam boiler which has already been in use, without applying a factor of safety which it believes reasonably safe for this type of construction. Eventually, the committee feels, the lap-seam construction must be displaced by a design that is free from the inherent defect known to boiler experts as "the typical lap-seam crack."

"Second-hand stationary boilers within the state of California on Oct. 1, 1920, by which is meant boilers where both ownership and location are changed, shall, if of lap-seam construction, have a factor of safety of at least six," says Sec. 381, a, of the proposed revision. Virtually identical installations in other communities show that the states of New York, New Jersey, and Pennsylvania require the same factor of at least six, while Ohio, Massachusetts and the city of Detroit will permit nothing under eight, except for boilers 36 inches in diameter or under, when the factor of safety is at least six. It would seem then that a factor of six could well stand, and that the objections urged against its adoption as being too high and as leading to prohibitive boiler practice should be overruled.

Unquestionably one of the most constructive pieces of engineering work ever undertaken by an engineering society is that of the boiler code of the American Society of Mechanical Engineers. This code goes into great detail as to how boilers should be properly constructed, the factors of safety involved in designing the boiler

GEO. L. MYERS, assistant to president, Pacific Power & Light Company —

"It is the obligation of power company and utility commission alike to safeguard the public and the dereliction of either does not excuse the other."

—Northwest Electric Light and Power Association.

and many other helpful and valuable rules for proper design and installation. Since the code was first promulgated in 1914, seventeen states and several cities, including Philadelphia, Detroit and Seattle, have adopted it as the official legal document for state inspection work. California has adopted the A. S. M. E. 1914 code as from Jan. 1, 1917, and the revised boiler safety orders propose to adopt the 1918 code. The California Industrial Accident Commission is to be congratulated on this forward step toward boiler safety.

Once again a new world's record is to be soon accomplished in the West in the matter of interconnection of power service. The tie-in of the San Joaquin Light & Power Corporation's lines with the Pacific Gas & Electric Com-

pany's lines at Newman, California, has previously been alluded to in these columns. While this tie-in made possible a solid connection of copper from Oregon on the north to the Mexican border on the south, and thence up into Nevada, it has hitherto been recognized that the transference of power was only small. By the first of the year, however, this interconnection is to be reinforced so that a total of 12,500 kw. may be continuously transported over this connection to all parts of the vast empire served by these transmission lines. During the last year this company was a purchaser from the Southern California Edison Company to the extent of 78,000,000 kw-hr. Since the installation of its new power house, known as the Kerckhoff plant, the San Joaquin Light & Power Corporation has at its disposal during next year 160,000,000 kw-hr., this being figured on the basis of an 80 per cent power factor, a 90 per cent use factor and a utilization of 70 per cent of

known law water supply of the San Joaquin river. The new tie-in with the Pacific Gas & Electric Company's system is to be accomplished by means of a 30-mile line from the Kerckhoff plant to Merced, Cal., over a 110,000-volt transmission line which is to be constructed with a capacity of 30,000 kw. The delivery of poles and the avoidance of car shortage and line material have been planned for, and it is confidently expected that the entire new work will be completed by Jan. 1. The means thus afforded for conveying a vast quantity of hydroelectric energy from one section of California in its extreme north to another section of California in the extreme south along the Mexican border almost overwhelms one with the future possibilities it opens up for interconnected systems serving the rich agricultural and industrial sections of the nation.

That the electrically equipped "New Mexico" should have outdistanced all competitors in the navy on the question of economy and indeed on many other counts of operating efficiency, comes as no surprise to those who have followed this type of application in the modern marine drive. It comes as a source of gratification to the West that fuel oil, which is a product in such vast quantities in this section of the nation, coupled with the electric drive, should have played such an important factor on board battleships bearing the names of Western states. The "California," now building at the Mare Island Navy Yard in California, is to be a sister ship to the "New Mexico," while the giant "Montana," the keel for which was laid only during the past few months at the Mare Island yard, will also have the electric drive improvements.

The New Searchlight Department

BEGINNING with this issue the Journal of Electricity inaugurates a new and helpful service for industrial activities throughout the West that can hardly be overestimated in value. At the present time no service is in existence for the Western states wherein the man without a position in engineering and industrial activity can possibly seek to find information regarding positions open, or the man who wants to employ trained men can turn to get lists of desirable men, nor is there a place where information can be had concerning used material in construction work on the Pacific Coast, either with a purpose of disposal or purchase. To date the Journal of Electricity is the only one of the McGraw-Hill family which has not inaugurated what is known as a "Searchlight Department" wherein all these matters may be completely attended to. The rates for doing this work have been made lower than the other types of advertising in the columns of the Journal of Electricity in order that the freest use may be made of this splendid new service by our readers throughout the West. It is believed that this will grow rapidly into a very comprehensive service for the industry, and readers and well wishers of the Journal of Electricity can help us beyond measure by following these items issue by issue, sending in to us inquiries to fill wants desired, and in every way boosting this new and unique service held in view by the Journal of Electricity, which issue by issue in the near future will be unfolded to our readers.

The Outlook for the Electrical Industry

BY JOHN B. FISKEN

(The most important problems now confronting the electrical industry were summarized in a striking way in the presidential address at the recent convention of the Northwest Electric Light and Power Association at Spokane, Wash. The address, quoted in part below, was delivered by John B. Fisken, consulting engineer for the Washington Water Power Company, at the close of his successful year of office as president of the Association.—The Editor.)

One of the clouds on our industrial horizon which has, so far as any visible evidence indicates, no silver lining, is that one representing taxes. The nation has an immense war debt to take care of and it will take years to get relief from that burden, but there are many ways in which some relief at least may be obtained nationally.

Taxation and a National Department of Public Works

The engineering work of the Federal Government is scattered practically through every department and each department has its own corps of engineers whose work is done without any attempt at coordination with the work of any other department. Not only is there no attempt at either cooperation or coordination but in many cases the engineering staffs of several different departments are working on the same work not only without cooperation but actually in opposition to one another. A movement was started in the spring of 1919 to devise means of removing the unnecessary tax burden due to this anomalous situation, which resulted, in June of last year, in the introduction in the Senate by Senator Jones of Washington, and in the House by Congressman Reavis of Nebraska, of a bill to create a National Department of Public Works, which department would do practically all the engineering work for the government at a greatly lessened cost. In May of this year, the Chamber of Commerce of the United States took a referendum vote of its members which resulted in 827½ votes in favor of the measure and 549½ votes opposed. Our own national organization, the N. E. L. A., voted in favor of the measure. Is it not possible that our Public Policy Committee could do something to interest the Congressmen from our states in favor of these or any other measures that will lead to a reduction in the Federal taxation?

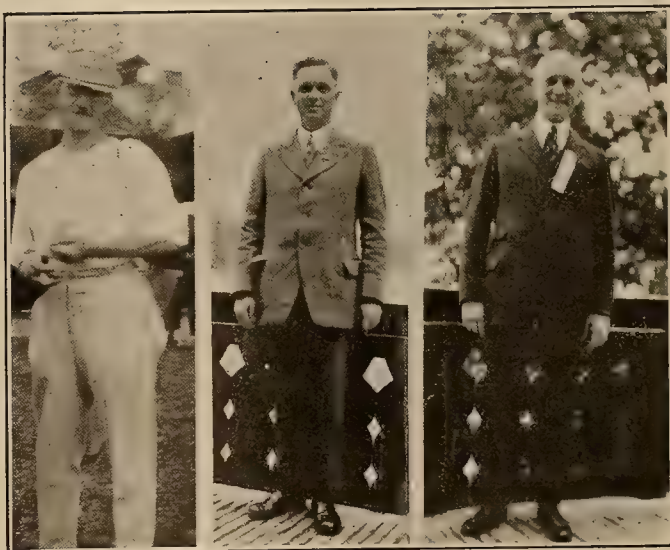
I have touched upon the inefficiency of the Federal Administration. Are our State Administrations any more efficient? Our State Public Policy Committees might well make a study of this question and if inefficiency is found to exist the facts could at least be furnished to our local stockholders and our customers; it might accomplish some good.

Increase in Rates

While the general outlook as regards the possibility of increasing our rates to meet our increasing expenses was not very favorable a year ago, the situation during the year has markedly improved. It may be that the public have come to a realization of the fact that a broken-down, bankrupt utility is a liability to the community, whereas a prosperous utility is an asset of great value. Be that as it may,

it begins to appear that the regulatory commissions, after about twenty years of catering to the public demand for lower rates irrespective of the cost, a demand urged by cheap politicians who adopted this method of playing to the galleries in order to secure a few votes, have come to a realization of the fact that the building up and development of the country is more dependent upon the ability of the utilities to furnish the services required than on anything else.

The advocates of municipal ownership, comparatively few in number, are still groping in darkness and are ignorant of, or refuse to acknowledge the fact that the ownership of privately owned utilities does not rest entirely with a few men of great wealth but as a matter of fact is scattered through the homes of almost every self-respecting citizen of the country. Some of the stock is owned directly but a very large part of the ownership of the utilities is indirect. Insurance companies and banks own liens on utilities and in some cases large blocks of stock, so that most men who carry insurance or have bank accounts are in some measure dependent upon the continued and successful operation of privately owned utilities.



On the left John B. Fisken, consulting engineer for the Washington Water Power Company, who, being Scotch, was at home both in the president's chair and on the golf links. To his able planning and tactful presiding much of the success of the convention was due. W. M. Hamilton (center) of the Portland Railway Light & Power Company presented the important paper of the convention of public utility management, and is here shown ready for the "action" he recommends. W. E. Coman at the right, general manager of the Washington Water Power Company, whose broad-minded policy has done so much to promote good feeling in the electrical industry in the Northwest, is here exemplifying the pleasant greeting extended by Spokane to the visitors at convention.

W. R. PUTNAM, general manager, Idaho Power Company —
"Public utility commissions can only keep one step ahead of public opinion—the cooperative league will be a medium for the education of the public."

—Northwest Electric Light and Power Association.



CONVERTED TO COOPERATION. DELEGATES WHO ATTENDED THE CONVENTION OF THE NORTHWEST ELECTRIC LIGHT

Regulation of Utilities

Attempts are being made to revert to the practice of the regulation of utilities by cities and towns, counties, school districts and all the various municipal subdivisions of a state instead of by the state itself.

The basic idea based on experience throughout the country, that the utilities doing business in more than one city or bringing power for distribution in a city from a point or points outside cannot satisfactorily to themselves or the public have their rate-making and operation controlled by other than a competent state commission, whose vision will not be limited by any city boundary but who can and will regulate the utility for benefit both to its stockholders and to the public which it serves, influenced the Chicago Association of Commerce to oppose the attempt which the City Council of Chicago made early in the year to secure the exclusive power to regulate the rates of public utilities operating therein.

It will not do for us to sit back complacently and allow this cloud to grow. I know from talking with intelligent, right thinking men that the situation is not understood by the layman as it should be, and our Association should use all its powers of education to enlighten the large majority of the citizens on this subject.

Financing Extensions

The necessity exists today in many localities for much increased facilities for furnishing electric service, perhaps not to as great an extent in the territory embraced in our Association as in our neighboring state of California. President Edgerton of the Railroad Commission, who is surely fully qualified to know whereof he speaks, stated at Pasadena that very large sums are and will be required by the utilities in California to enable them to furnish the service demanded by the people of his state. He said:

"I started in with \$250,000,000 in the next ten years, and I have been raised now to \$500,000,000; and I don't know where it is going to end."

At the same convention Past President Ballard made the statement that "the industry needs approximately \$750,000,000 of new capital right now

to care for the expanded requirements of the country."

The Investment Bankers' Association of America in its annual report issued last winter says, relative to the electric light and power industry:

"It should not be difficult to educate the public to renewed and increasing confidence in an industry which has proved itself, even in the crisis of war, so stable, so resourceful, resilient and productive, and which offers convincing promise for safe and remunerative capital."

And the Board of Governors of the Association, after a series of conferences between their representatives and Executive Manager Aylesworth and a special committee of the National Electric Light Association, passed a resolution which stated that the following steps should be taken to restore the credit of the utilities:

"1. Term franchises should be superseded by indeterminate permits securing the right to operate under proper regulation during good behavior with provisions for equitable adjustment of rates from time to time, as tending to eliminate controversies which inevitably impair the public service, the credit of the companies involved and the value of their securities."

"2. The power of regulation and control of public utilities should be vested in state commissions as tending towards standardization of regulation which is not possible under local regulation."

"3. Members of state commissions should be appointed. If commissioners are elected they are frequently embarrassed by political policies and platforms in the consideration of questions which should be decided only on sound economic and financial principles."

The August N. E. L. A. Bulletin stated that copies of this resolution had been forwarded to all members of Congress, to all state regulatory bodies, to all officers of all states, and to the mayors of the larger cities throughout the country. Copies have also been sent to Rotary Clubs. It remains for our Association through its Public Policy Committees and its Public Relations Section to spread the doctrine still farther and to follow up the suggestions by every means in its power.

The National Association and the Geographic Section

The National Electric Light Association, of which our Association is a geographic division or section, enjoyed for many years a calm and undisturbed repose. Some few years ago its slumber



AND POWER ASSOCIATION AT SPOKANE, SEPTEMBER 8-11, 1920, AND ADOPTED A PLAN OF COOPERATION IN THE INDUSTRY.

began to be disturbed, whether due to nightmares taking the form of phantoms of western activities or not I cannot say. At its annual convention last year a Western man, R. H. Ballard of Los Angeles, stepped into the presidential chair and almost immediately the slumbering giant yawned, stretched itself and awakened; that it will ever be permitted to slumber again is, to my way of thinking, extremely improbable.

The keynotes to President Ballard's administration were decentralization of activities and efficient service to members.

Owing to the organization of geographic divisions by the National Association it became necessary for us to amend our constitution. A special meeting was held at which Article I was amended so as to eliminate British Columbia and include Utah. I have endeavored to arrange for the re-inclusion of British Columbia in our territory, but possibly on account of the long distance between here and New York, I have nothing favorable to report on this situation. The British Columbia companies would, I have reason to believe, welcome the change, but the Canadian Electrical Association opposes it largely, as I am given to understand, for political purposes. I am sure we would more than gladly welcome our Canadian friends into our membership and I would urge that the matter be not allowed to drop.

Service to Member Companies

President Gille in his address last year suggested the advisability of our Association having a secretary who would give his entire time to the office. He suggested as future activities which could be undertaken, if this was done, industrial research for developing industries employing electricity as a motive power and cooperation with civic and other associations to that end; keeping member companies informed in all matters relating to rates; having a representative attend rate hearings before the Public Service Commission, to furnish data and assist in working out rate problems. My experience during the past year leads me to endorse very heartily Mr. Gille's suggestions. I would go further, however. I believe this Association should furnish service to its member companies, especially to the smaller com-

panies which do not have on their staff men trained to cope with the various problems as they arise. This could be done by having the secretary visit the companies and find out what their troubles are and through the different sections get to them a solution of their difficulties.

Public Relations Section

One of the important functions of the Public Relations section will be to educate the public; to bring to the public a very large measure of realization of what the utilities really contribute to its welfare, apart entirely from the service furnished to it individually, and to cause it to give its whole-hearted endorsement to the growing tendency among the far-seeing regulatory commissions to assist in the development of the country by permitting the utilities to charge such rates for their service as will return a reasonable dividend to their stockholders on their investment. Among other means which have been proposed to accomplish the desired result is that of the formation of state committees composed of representatives of all privately owned utilities of whatsoever nature operating in the state. Such committees have been organized and are accomplishing good results in Illinois, Indiana, Kentucky, Ohio and Nebraska, and will probably be organized in Iowa, Wisconsin and Texas.

The utilities in Illinois were the first to take up this work and have established a program which will undoubtedly be followed in other states.

An Expression of Appreciation

No address at this time would be complete without containing an expression of appreciation of the helpful interest in our industry displayed by the Technical Press, and while invidious comparisons are never in order nor in good taste, I do not think I will draw any criticism when I refer specifically to our own Western magazine, the Journal of Electricity—long may it prosper.

W. M. MEACHAM, Meacham and Babcock, Seattle —

"Each branch of the industry is working along parallel lines—the cooperative league will be the binding cord which keeps this work in harmony."

—Northwest Electric Light and Power Association.

Competition in the Public Utility Industry

BY GEORGE L. MYERS

(That the economy of effort and resources inherent in monopoly should point towards a monopolistic rather than a competitive system for public utilities under state regulation, is strongly brought out in the following paper presented at the recent convention of the Northwest Electric Light and Power Association at Spokane, by the assistant to the president of the Pacific Power & Light Company.—The Editor.)

The principal concern of the user of any form of public utility service is the assurance of efficient service and at rates consistent with the quality of the service rendered. From economic and political standpoints the consumer's interests demand the establishment and adjustment of conditions from time to time which will best assure the permanency of these essentials. Until recently the public generally relied to a large extent upon competition as an important factor in securing these results. How greatly that confidence was misplaced is a matter of record to all familiar with the history of these enterprises, but it does not follow that the consuming public generally even now fully realizes the fallacy of relying upon competition as a means of protecting its interest.

Competition has been generally regarded as essential to our economic system—as a means of natural regulation of price and as the necessary incentive to industrial progress. Monopoly has been looked upon as obnoxious and not to be tolerated. It may easily become intolerable and indefensible if unrestrained and unregulated. The power to work its will arbitrarily in economic control of any of the pursuits of enterprise must be met by the sovereign power of political control. Self-interest and self-preservation from the public's standpoint demand that it be subject to effective government regulation.

Normal and Abnormal Monopoly

The development of industry from the old order of small scale production by the individual or partnership to the new order of large scale production by the corporation has brought about more efficiency and economy and great economic power. We cannot wisely because of fear of such power allow ourselves to destroy the economic gain of this new order. This gain may be fully preserved and the public amply protected by the application of recognized powers of government supervision.

Where monopoly is the result of natural development, or is a condition natural to a particular industry, common sense dictates that this condition be compelled to serve the public welfare. Where monopoly is attributable to unfair practices and methods, and is not essential or beneficial to the public interest, it is our duty to provide legislation and regulation that will restore and maintain the free play of competition. We should be able to distinguish the natural from the unnatural and, with this distinction made, to apply the appropriate political treatment. There has been a growing recognition of the fact that the interests of the people may be injured as well as benefited by competition. It is for this reason that monopoly is being recognized as a natural condition in the public utility industry.

Competition in public utility service has not been the rule, but the exception. Thus the general condition has been one of monopoly within the territory served by the average utility. It was because of this preferential economic situation, where the privilege to do business generally became exclusive in practice, that regulation became established as a governmental policy. The sporadic or occasional abuses and corruptions of old time managements and disregard for public rights and sentiment were the effects of unrestrained, uncontrolled and unregulated monopoly. Regulation to the extent of control of service, rates and accounts and determination of values and return in any industry is defensible only under conditions of monopoly.

Reasons For Public Utility Monopoly

The reasons why monopoly is generally prevalent in the public utility industry are the cost and physical fixity of the investment, the obligation to meet all reasonable demands for service, and the limitations of the market and its normally slow development, which latter condition affords a volume of business that is generally not sufficient to maintain competitive conditions.

The money invested in a public utility is usually greater than that of any other single enterprise in the average city and community. Large amounts must be spent for physical property of a fixed and immobile nature, which cannot be taken up and moved elsewhere, except at great expense, and much of it not at all. If it becomes useless for the purpose it serves it has only a negligible value. The fact that the investment is so large and is not mobile or convertible serves to discourage competition. The mobility and convertibility of the average industrial plant encourages competition, because the risk is less. The investment is less. The earnings on the capital invested are much greater because there is a quicker turnover. This makes amortization possible within a reasonable period under normal conditions. The public utility with its restricted earning power under regulation cannot fully amortize its investment. The average ratio of investment to income and the competition of other means of power make it impossible even without regulation to do it. Figures and experience under normal conditions disclose that for every dollar of new annual revenue to an electric utility a capital expenditure of \$5.00 must be made. Particularly is this true in the West, where the volume of available business is relatively small and rates to encourage development necessary.

The ordinary industrial enterprise is not subject to the market limitations of the public utility. The latter is confined to the territory served. The former can reach the world. The market of the

public utility is of average slow development under limitations. In the ordinary enterprise it is what the productive genius and sales enterprise make it.

Capital investment of large amount, with large fixed charges, restricted return, immobile and limited in scope and development of market naturally tends to establish monopoly. Capital investment of quick prospective turnover, unregulated in return, mobile, and without such limitations in market, tends to maintain competition.

Monopoly can be accepted as a condition only where the circumstances make it possible to regulate to the extent of fixing prices. This is possible where values can be fairly determined and service based upon cost and a return sufficient to attract capital for investment and to compensate it for the risks undertaken and the skill, efficiency and economy of its management. The variable conditions in industry as a whole do not permit of price regulation. The volume of production, the extent of demand, the incentive to profit, the competition of substitutes and other economic ramifications regulate.

To sustain the contention that "the general condition has been one of monopoly within the territory served by the average utility" an investigation has been made of conditions of competition in the states within Association territory, namely, Idaho, Montana, Oregon, Utah and Washington.

The following is a table setting forth the number of communities that have electrical service and the number where the condition is one of monopoly and of competition, with a segregation where competition prevails as between municipal and private utilities:

State	Communities Served	Monopoly	Competition	Municipal	Private
Idaho	149	147	1	1	
Montana	122	122	0		
Oregon	191	190	1		1
Utah	188	180	8	2	6
Washington	275	268	7	5	2
Total.....	925	907	17	8	9

The United States Government in its operation of the postal system does not and would not tolerate competition. No city that operates its own utilities would do so. The Federal Government would use every honorable means to prevent the construction of another canal across the Isthmus to protect its tremendous investment in the Panama Canal, because competition would increase materially the burdens of taxation. Already a realization of the wasted efficiency and capital in competitive facilities for railroad transportation has brought about a large and growing sentiment for a recognition of the advantages of monopoly and the necessity for a larger measure of Federal control, which a greater concentration and centralization of management and direction in some regional plan would serve to simplify. The user of the service of competitive telephone systems keenly feels the added burdens of service in two or more bills instead of one if all users of telephone service are to be reached.

Special Responsibilities in Public Utility Service

A public utility is chartered by government. It is vested with the sovereign power to take private

property for its use even without the consent of the owner. The acceptance of this sovereign power operates to dedicate its property to public use. This power obligates it to render a public service, adequate and without discrimination and at reasonable charges. The grant of this power and the generally exclusive exercise of it justifies and necessitates an exercise of the sovereign power of the state or its agent to see that the obligation is fulfilled. That there has been recognition of the fact that this obligation can be met with greater economy and benefit to the consumer by monopoly is evidenced by the legislative acts of 23 states of the Union that empower their commissions to permit or deny competition by the grant or refusal of a certificate that the public convenience and necessity are subserved or met thereby. Public utilities are regulated in 37 states. In more than a majority, or 62 per cent, there is regulation of competition. Twelve of these states provide that the power of their commissions shall include municipalities. This shows the extent to which this principle has become rooted in the political and economic life of some of the states. Public utilities in such states are not to become subject without cause to the unfair competition of municipalities, with their exemption from taxes and ability to draw upon the resources of the community, even those of their competitor, to make up deficits through taxation.

The following is a table setting forth states where regulation of competition prevails, showing the extent of such regulation as to private and municipal utilities:

States	Private Utilities	Municipal Utilities	States	Private Utilities	Municipal Utilities
Arizona	Yes	No	Nevada	Yes	No
Arkansas	Yes	Yes	New Hampshire.....	Yes	No
California	Yes	No	New Jersey.....	Yes	No
Colorado	Yes	Yes	New York.....	Yes	Yes
Idaho	Yes	No	Oregon	Yes	No
Illinois	Yes	No	Pennsylvania	Yes	Yes
Indiana	Yes	Yes	Tennessee	Yes	No
Kansas	Yes	No	Utah	Yes	Yes
Maine	Yes	Yes	Vermont	Yes	Yes
Maryland*	Yes	Yes	Wisconsin	Yes	Yes
Massachusetts	Yes	Yes	Wyoming	Yes	Yes
Missouri	Yes	No			

*City of Baltimore excepted.

NOTE.—The fourteen states other than those listed above where there is regulation of public utilities are Alabama, Connecticut, Georgia, Michigan, Montana, North Carolina, North Dakota, Ohio, Oklahoma, Rhode Island, South Carolina, Virginia, Washington, and West Virginia.

The Railroad Commissions of Iowa and Nebraska have certain jurisdiction over construction, operation and maintenance of electric transmission lines, and in Nebraska over capitalization. There is regulation in the District of Columbia and the territories of Hawaii and Porto Rico and the Philippine Islands. In Porto Rico and the District of Columbia there is control of competition applicable to both private and municipal utilities.

Destructive Competition

The Railroad Commission of California has established a policy of holding out the threat of potential competition as a penalty for failure to give adequate service. Let us take a hypothetical case. An existing public utility fails to give adequate service. Another public utility applies to the Commission for the privilege to enter. The Commission determines

ROBERT SIBLEY, editor *Journal of Electricity* —

"Every branch of the industry is concerned in the success of the central station—and the new direction of cooperative effort is toward the marketing of power company securities."

—Northwest Electric Light and Power Association.

upon investigation that the existing utility has failed in its obligation to give adequate service. Predicated upon this finding the Commission must grant the right to enter. A competitive warfare ensues. Each utility has a certain endurance to withstand competition. Neither can sell its service at a loss and continue to do it. Neither the state nor the city can give either an advantage through regulation or legislation. One of three conditions will result—combination, confiscation or an understanding. Combination, because neither is disposed to play a losing game by keeping the available revenue divided; confiscation, because the utility of greater resources has survived the weaker; or an understanding because each has come to an agreement that it is better to maintain a parity of rates and let each live by asking for the necessary relief in added revenue that will permit each to earn a fair return. In any event a duplication of facilities for service has resulted. If either combination or an understanding prevails rates necessarily must be increased to pay a return upon the invested capital. If the investment of one has been entirely wiped out the monopolistic condition has been restored and the capital of the loser wasted. It may be the utility it was sought to punish that has lost or it may be the utility that was to administer the punishment. The consumers suffer directly in the case of combination or an understanding and indirectly, at least, in the event of confiscation. Capital cannot be wasted without economic loss. The threat of competition may have its value as an assurance of adequate service, but it is questionable whether the necessity to carry it out is of greater value to the public than the risk of economic loss or waste.

Commissions have almost unlimited powers of regulation and should perform their full duty, and it would seem to be the policy of greater wisdom to fearlessly and vigorously enforce the power to control the conditions of service by compelling adequate service, either by the grant of the necessary revenue to do it where necessary or by compelling negligent management to conform to acceptable standards of service.

Wasteful Duplication of Service

Does competition render a service to consumers in respect to rates and development? If the return for capital invested is to be limited to a reasonable one upon a determinable value, competition can regulate rates downward until the limit of the endurance test of competition has been reached. Nothing can be sold indefinitely at less than a profit. A loss cannot be constantly sustained. Therefore, competition cannot be a permanent condition and regulate rates. Sooner or later the revenue must be made to yield at least a reasonable return. If the revenue is divided and the facilities of service are duplicated, obviously the revenue to yield that return must be obtained through increased rates. Whether competition nominally still exists the policy of live and let live must prevail.

When the fact is taken into consideration that the price of service is governed by the volume of the

output sold it can be readily understood that any division of the volume necessarily means more must be paid for each unit of service. The extent to which the investment is duplicated by competition proportionately increases the fixed charges and there is an increase in expenses of operation and maintenance, together with taxes, which would not have to be borne by the consumers of service if the service were free from competition. Hence, the consumer benefits to the extent that the ratio of volume of output sold to the investment can be increased.

Capital used to provide duplicated facilities of service cannot be used to add to the facilities of service and increase development. The revenues foregone to survive competition make it more difficult and thus more costly to meet the demands and need for development. The resources of the new utility are largely spent to take as much as possible of the profitable business of the old utility, which restricts the ability of the latter to finance new developments. Capital is naturally timid. Its risks must be compensated. Without competition the capital takes the form of an investment and with it that of the speculative must be taken. Freedom from competition more nearly assures the security of the principal and a constant reasonable return for its use. Competition jeopardizes both principal and return. Development is therefore retarded.

Dangers of Speculation

Where the opportunity for competition has been left open irrespective of conditions the speculator has oftentimes victimized the developer and operator. Either the threat or actual state of competition has compelled the operator to purchase the property of the speculator as a legitimate measure of protection to the investment. Vicious advantage has been taken of the larger companies because of the adverse influence that a competitive condition, even of minor proportions, has upon the estimate of the prospective investor as to the stability of the investment. The prospective investor, not having an intimate knowledge of the actual condition of the property and its soundness, necessarily magnifies its importance even though unjustified. It is much easier for the investor to be alarmed than assured. He is naturally obsessed with more skepticism than confidence. The mere presence of competition reflects adversely upon the financing of a property as a whole. The investor does not know to what extent it may grow. It has not infrequently occurred that possession of an undeveloped water power for the available possible output of which there was no real economic demand or need has been used as a speculation because of its possibilities in potential competition. The speculator has not only demanded its market value, but has included a nuisance value as well, as the price of non-interference with the service of the bona fide operator. Such practices are of economic injury and the morals of such a speculator are those of the holdup artist. Regulation of competition by protecting and encouraging development prevents and discourages vicious speculation.

Competition of Modern Improvements

Absolute prohibition of competition would be inconsistent with the public interest. The unforeseen developments in the arts and science and in the processes of our economic life make it necessary that competition should be possible—that the justice and wisdom of its existence must be determined from the variable facts and conditions in each case by the judgment of fair men under the law as an administrative act and not made impossible as an act of legislation. The possible development of new facilities or resources in the inevitable march of progress makes it necessary and desirable that there should be opportunity to allow competition, when, in the judgment of properly constituted authorities, the fact is clearly established that the proposed competition represents a permanent advance in service over the existing utility.

The horse-car as a means of transportation had to give way to the electric car and the electric car may have to give way to the motor vehicle. No one of these means of transportation can be protected from the competition of air craft. The operation of a water line cannot be denied because it competes with a rail system. Nor can the competition of motor vehicles over our increasing mileage of improved highways. The electric utility could not expect protection from the gas utility and vice versa. Each utility has its characteristics and possibilities for greater service. All that the existing utility may properly demand in such a case is that the proposed competitor be required to furnish as complete and adequate a service and under comparable burdens and obligations to the public. However, opportunity should be given to earn enough to meet the reasonably anticipated needs of obsolescence by adequate amortization to meet new developments within the industry that are discernible and to obviate the necessity wherever possible of competition.

While it is true that under conditions of economic restraint only there is no obligation to protect or preserve an investment that progress has made of no real economic value, nevertheless, under conditions of regulation as practiced there is a moral obligation to see that a public utility has the opportunity to protect itself in the return of its capital.

The Inevitability of Progress

There has been argument that not to leave competition absolutely free will serve to discourage use of improved facilities developed in the arts and science and that inventive genius will be discouraged. Competition has been very much the exception and if the future is to be judged by the past this argument is not tenable. It is within the power of regulatory authorities to compel utilities to give service in keeping with modern methods. Manifestly, under regulation it is as much the duty of regulatory authorities to enforce modern standards of service as it is the obligation of the utility to use and apply them. Incompetence and neglect by either does not absolve or excuse the other. Both have a public trust to perform and respect.

However, the pressure of demand upon available means of supply will have a most desirable influence toward the use and exercise of modern means and practices.

Regulation that has an eye to the service of the public utility in economic development and progress generally will offer inducement to use improved facilities and methods by making it possible for some equitable distribution to be made between the management and its patrons of the profits from what is saved.

Furthermore, improved facilities and equipment that make for the economy and conservation of electrical energy are the products of the manufacturers of appliances and equipment. It is inconceivable that those for whose use they are designed and perfected can discourage their manufacture. It is the business of the manufacturer constantly to promote and develop improved processes. They will see to it that these improved processes are brought to public recognition and their use made inevitable.

It is the purpose of our Federal patent laws to foster and encourage invention and you cannot stifle the irrepressible spirit of the geniuses that bring them into recognition and use. It is impossible to defeat the purpose and results of applied knowledge. The unseen and inexorable laws of natural progress are impregnable to such artificial forces as may endeavor to challenge them.

The Economical Use of Capital

At no time in the history of the world has there been greater need for intelligent, efficient and economical use of capital. We have just passed through a period of war on a vastly greater scale of destruction than at any other time in history. We have produced to destroy. Now we must produce to build.

Our progress is largely dependent upon the use that we make of capital. If we use it intelligently, efficiently and economically we can produce more, and if we produce more and maintain the purchasing power of the producer we can live better. Our needs and comforts will be more amply supplied and we will reach a higher standard of living conditions. Thus the morale of our people will be strengthened and the improved quality of our citizenship will give us greater economic, social and political stability. Capital and the efforts of labor should not be wastefully or inefficiently utilized or expended if the greatest possible service is to be rendered.

Equitable Regulation

Therefore, the industry that is so regulated that return is limited should be kept free from competition if the facilities of production and distribution are identical in order to conserve capital for its greater economic use. What has been invested and what will be invested in competitive public utility enterprises of identical nature may not be of an

W. H. ONKEN, JR., editor *Electrical World* —

"The best protection against competition is the complete service of the community by the original company."

—Northwest Electric Light and Power Association.

amount to appreciably influence the cost of money to the industry. However, the need to conserve capital and put it to the best use is not a problem of degree. It is possible to do it where the condition is one of natural monopoly and capable of such regulation as to fix charges and standards of service.

Regulation is correct in principle and should be made fair in practice—fair to the public and fair to the investor. If the principle in practice is to determine the conditions of service, character of rates, the fair value of property for purposes of rate-making and the reasonableness of return, is there not an obligation, in some measure at least, to protect the investment? Assuming that the purpose of the law is met by providing a reasonable return upon a fair value, is it unreasonable to ask that if these limitations are to be prescribed the industry be protected from competition? It is as wasteful and as foolish to allow competition under regulation as it is to

allow two men to drive the same nail. There is only one nail to be driven just as there is but one public utility service of identical nature to be rendered. There is a duplication of labor and capital to drive the one nail and a duplication of capital and labor to furnish the one kind of service. Regulation in the sense of control of public utilities as exercised is in truth uneconomic. It leaves no opportunity for economic law to be free to regulate. It is a denial of the efficacy of competition as a regulator of rates and service.

Regulation is a task of large undertaking. Its problems are many and perplexing. Anything that can be done to simplify regulation will make it more efficient and successful. For this reason if the complexities of competitive situations are eliminated the purposes and objects of regulation can be better served and achieved.

Technical Section's Report to the Convention

(In the one year's time during which this Section of the Northwest Electric Light and Power Association has been in existence remarkable results have been achieved. Acting through its own membership and that of the National Committee, it has gathered data which should be of vital interest to the central station utilities of the Northwest.—The Editor.)

The Governing Committee of the Hydroelectric and Technical Section of the Northwest Electric Light and Power Association has summarized in a complete manner the reports of the various Committees of this Section as presented at this, its first convention. At the same time the Committee traced some of the steps in the evolution of the Association work up to the present time.

Even though the Section has been in existence only a year, the Committees have proved themselves to be of inestimable value. Working through their own membership and with the Committees of the National Association, the problems and experiences of the country have been brought to the Northwest and, through membership in the National Committees, the problems and experiences of the Northwest have been given to the country at large.

ELECTRICAL APPARATUS

Progress in standardization has required the closest cooperation between the manufacturer of electrical apparatus and the user, and it depends upon their combined ingenuity and experience. Probably the most important point of contact today between the manufacturer and the user is that existing between the Power Club and the Electrical Apparatus Committee of the N. E. L. A. And the Association's committee is rendering a service of no small value to the National Committee. The report takes up in detail the experience and practice of various member companies in connection with twenty different subjects, enumerated below:

Experience with and Application of Reactors.—The use of reactors has been more general in the East than in this part of the country, it being applied more in the case of stations running over 10,000 kilowatts, but they are coming into more common use yearly.

Grounding of Neutrals of Generator Windings.—One company reports that it does not ground the neutrals of its

generators, but in the case of two other companies it seems to have been beneficial.

Generator Field and Armature Failures.—Not many cases of failures are reported considering the number of machines and the length of time covered, but the explanations for such failures are of great interest.

Unsatisfactory Results From Varnished Cambric Station Cables.—The use of such cable seems to have been generally satisfactory.

Experience with 600-Volt Synchronous Converters.—Most of the experience with synchronous converters in the Northwest has been with 600-volt railway apparatus, and the experience of the different companies is of a great deal of interest. The experience of the Portland Railway, Light & Power Company in changing from 33 to 60 cycles is particularly worthy of note.

Relative Advantages and Fire Hazards of Air-Blast and Oil-Cooled Transformers.—There seems to have been only one case of fire in large oil-cooled transformers, while several cases of fire in air-blast are reported. It would seem that the preference would lie in favor of the oil-cooled, even though from the insurance companies' standpoint the fire hazard is greater.

Induction Regulator Failures and Character of Regulator Installations.—Few failures are reported and the causes for these failures have been largely remedied in later designs of this type of apparatus. The feeling that any special protection for such equipment as is proposed by the National Electrical Safety Code of the United States Bureau of Standards is unnecessary seems to be general.

Standardization of Best Arrangement of Generating and Sub-Station Bus- and Oil-Switch Structures.—It would appear that this is desirable and that the construction should be as rugged and as open as possible.

Excitation System.—Both individual exciters mounted on generator shaft and combination waterwheel and induction motor-driven exciters are being used with satisfactory results.

Transformer Purchase Specifications.—Not much expression of opinion has been given us on this point.

Oil Switch Failures.—Apparently this trouble has been of serious nature and we would call attention to the desirability of further investigation for the reasons for such failures as well as the standardization of ratings.

Tendency Towards and Development of Automatic or Semi-Automatic Sub-Stations.—This is a development with which our companies have had little experience but it is significant that they are being seriously considered.

Experience with Iron and Copper Cooling Coils.—With the exception of one company, copper coils are generally recommended, particularly on account of the tendency for iron coils to choke with deposits of impure water, it sometimes having been necessary to flush them several times each day.

Standardized Transformer Polarity.—This should be adopted.

Use of Warren Clocks in Maintaining Frequency.—None of our companies report the use of such devices, and it would seem difficult here on account of the distance apart of the generating stations.

Standardization of Transformer and Switch Oils and Tests for Same.—This is recommended.

Advantages of Separate Control Batteries in 250-Volt D.C. Sub-Stations.—If emergency batteries are not present it is our opinion that separate control batteries should be installed in all stations where switches and apparatus are electrically controlled.

Locking of High Tension Bus and Switch Compartments.—This seems to be unnecessary, as no unauthorized persons are supposed to enter rooms containing same under our State Safety Rules.

Sub-Station Fire Fighting Equipment.—All sub-stations should be provided with such equipment. Dry sand is a great assistance in this particular.

Use of Wireless Telephone and Telegraph.—One company has used this with very good results. The outcome of the experiment which is now being tried in the East, viz., telephoning over high voltage lines carrying current, is being watched with interest.

In the discussion which followed, M. T. Crawford said that cable troubles reported by the Puget Sound Power & Light Company had been due to having lightning arresters on the plant side of the cable; they have been placed on the line side with better results. Mr. Lindsay urged the study of oil-switch problems. He brought out that Western plants had reached the capacity of the switches manufactured at present, and that there was needed either new types of switches or a sectionalizing of lines to avoid disastrous explosions in the future.

METERS

While the average engineer probably will not agree to it, the commercial man will say that the most important class of equipment on the central station system is the meter. Of the dozen or so men in the Northwest who are competent to discuss the technical phases of metering, some of them are on the Committee on Meters, part of the report of which follows. Improvement in present methods of measuring demand and in metering practice generally is the goal at which this committee has been earnestly working.

More active participation by men in the Northwest with the work of the National Committee on Meters has been effected, and much data has been compiled and forwarded to the chairman of that committee, in the report of which it has been embodied.

Considerable interest was manifested in connection with the supply of a sufficient number of properly trained meter men, and a committee has prepared a course of study which may be followed to equip young men. Discussion brought out the good results already gained from this education in accuracy, lack of labor troubles and the chance for advancement.

The section of the meter code for maximum demand meters was completed during the year and now

is known as Section 10. It is recommended that those in charge of meter departments of this Association study this section of the code carefully as it will better enable them to secure the device for more nearly giving them the desired results where the demand of a certain type of installation is required.

It has long been recognized that a considerable saving of time and less liability of error would result from the adoption of standard disk constants. Manufacturers have agreed to the desirability of a change, and as soon as manufacturing conditions warrant it is expected that these will be put into effect.

Outdoor metering at moderately high potentials is becoming a common custom in the West, but the results of manufacturers in their attempts to meet the situation have not been entirely satisfactory. Without doubt, more study on the subject will bring about suitable standards.

The importance of the consumer's demand is being given more consideration for rate making and distribution purposes, with special reference to the smaller consumers. Considerable progress has been made by manufacturers of demand and graphic meters during the year past and the importance of studying power-factor recording devices was urged by Mr. Gille in the discussion that followed. The committee is looking for still greater developments of a simplified demand meter from the producers, when power companies shall have arrived at a proper rate for their service.

PRIME MOVERS

It is generally recognized that this Association is more deeply interested in water than in steam as a prime mover, and as the appointment of the Northwestern Committee took place so late in the year, it refers its Association to the report of the National Committee on Prime Movers, a great part of which refers to steam generation.

With the formation of the Hydraulic Power Committee of the National Association at Pasadena this year, because of the predominance of water power in the West, this Association will be well represented in its personnel.

INDUCTIVE INTERFERENCE

In view of the fact that few physical problems confronting the light and power utilities of this country are more important than the inductive interference problem, the committee has gone to great length in assisting the National Committee to formulate a nation-wide plan of action which will produce a basis on which to handle this question, interest in which is becoming so active among power distributing companies and communication companies. Close co-operation has been offered by the telegraph and telephone companies which are informing themselves

D. I. CONE, Pacific Telephone & Telegraph Company, San Francisco —

"It is a good sign when both communication interests and power companies are studying inductive interference as a general problem rather than as a series of special cases."

—Northwest Electric Light and Power Association.

with admirable thoroughness on every phase of the interference problem.

The deplorable situation of the power companies is reflected in the requests for advice received by the committee in specific Interference cases. These reveal the immediate need for formulation of governing principles by which the merits of each case can be measured and upon which a consistent policy can gradually be developed for the guidance of the power companies. An important feature in the National situation is the growing activity of state commissions in the matter of rules to govern inductive interference.

Among the principal things thus far accomplished by the National Committee are:

- I. Establishment of contact with all parts of the country, and organization.
- II. A first draft of governing principles (not yet complete).
- III. Accumulation of a large amount of data.
- IV. Establishment of a consulting relation with member companies.
- V. The initiation of joint work with the sub-committee of the A. I. E. E. that is investigating the so-called telephone interference factor.
- VI. The establishment by the N. E. L. A., at the committee's request, of a technical staff, and partial formulation of a program for technical work.

The West has a representation of nearly one-third on the National Committee.

Since July of this year, a few first principles have been deduced which could be considered sufficiently evident and established to warrant tentative adoption. The report outlines those in full and brings out some conclusions resulting therefrom.

There is already available a large amount of material of a technical, statistical, bibliographical and legal nature, to which considerably more will be added as it becomes available, to form an encyclopedic collection with analyses and summaries in three appendices. It is further proposed to present the more essential material in the form of a data book to meet the needs of the average power engineer.

Several cases of interference are presented in connection with the consulting relations work, which work will be difficult until a code of basic principles has been adopted.

A modification of the present wave shape standard for the no-load wave shape of synchronous machinery is being considered, to be known as the Telephone Interference Factor (t.i.f.). The method of measurement of this t.i.f. is given in the report, and other data concerning it.

To meet the requirements of the situation, as revealed by the first year's work of the committee, the executives of the Association, acting upon the committee's recommendation, have retained the services of W. J. Canada and Frank F. Fowle. Mr. Canada has immediate supervision of the technical work undertaken by the committee, and Mr. Fowle will act in a consulting engineering capacity. While the Technical Staff will carry on the active work, it will maintain close contact with and work in conjunction with the committee.

It is not the intention that extensive engineering research work be taken up this year, since this would involve the construction of an experimental

parallel, which would have to be at least eight miles in length, corresponding to the standard transposition and loading sections of the A. T. & T. Co.

Under Mr. Canada's direction, work along definite lines is now being initiated, and the report outlines the procedure.

OVERHEAD SYSTEMS

With 34 per cent of the total investment of property in overhead systems; the problems and costs incident to the operation and maintenance of overhead lines has been extensively studied by the Association's Committee and presented in detail in the report of the National Committee. Construction methods and materials, maintenance methods and materials, insulator maintenance—these are the three topics on which questionnaires brought forth such a splendid response from the companies.

Maintenance of alive wires has been given much thought, and several companies returned full reports on this question. The Committee treated in an exhaustive manner the preservative treatment of poles and crossarms, but apparently no settled opinions exist among the companies as to either preservative or process. It was brought out, however, that merely the painting of the pole did not prolong its life. In the discussion on cross-arms treatment, it was decided to be merely a matter of climate.

Following up pole protection in the discussion, Mr. Fisker recommended the Harding method of reinforced concrete around the pole. He also said that his company burned off the weeds from around the pole once a year. Mr. Boykin reported good results by using waste products from garages for killing weeds.

In the matter of insulator resistance, reference is made to the report of the National Committee. The Overhead Committee is working through the Safety Committee in an endeavor to cooperate with the Bureau of Standards, particularly in the re-drafting of part 2 of the Code. Loading and strength requirements of pole construction require further consideration, although results of the survey demonstrate to the Committee that even the 1916 Code would be exceedingly difficult to comply with, much less the more rigid conditions proposed in the suggested changes.

The Washington Electrical Construction Statute, it was shown, would compel over a million dollars in cost of changes if it should be permitted to go into effect in July, 1922. Its dangers were pointed out in the discussion, and its retroactive effect. All effort is to be made to have the act repealed before the next session of the legislature of that state.

An exhaustive program has been laid out by the Committee in conjunction with the national body, and because of its large representation in that body, the Northwest has been kept well advised of activities affecting overhead work.

UNDERGROUND CONSTRUCTION AND ELECTROLYSIS

The promise of better cables and their more intelligent use by the utilities is one result of the work of the Committee in the completion of cable

specifications which followed investigations of dielectric losses, etc. While underground construction in the Northwest is at present confined to a few of the larger companies, still it is becoming more common, especially in submarine crossings and for building entrances.

Especial interest is manifested in safe operating temperatures for cables, because nearly all power companies are facing increased load conditions that demand working cables to their ultimate limit or purchasing new cable equipment. Results are being secured toward better and more reliable cable to meet the occasional overloads. In particular, manufacturer measurement of dielectric power loss per foot and the power factor of the charging current are covered in the new specifications.

The report takes up I²R losses and dielectric losses, direct practice, potheads and junction boxes and practice in finding of faults. In the discussion, Mr. Le Fever gave the figures of some cable tests which showed more unsatisfactory results with varnished cambric than with paper insulation.

SAFETY RULES

Activity in the matter of regulations to promote safety in the central station industry is still confined almost entirely to the revision of the 1916 edition of the National Electrical Safety Code of the Bureau of Standards. The only notable exception is found in California, where the power companies have brought out a code independent of the Bureau. It is reported that this code has been accepted by the Railroad Commission of California and will soon go into effect. As a result of this action in California, there is reason to believe that certain modifications will be made in the National Electrical Safety Code which will make it more acceptable to power interests generally.

The Committee has watched closely the monotonous progress of the code, and has stood firmly against the upward revision which is proposed in some of the rules. In connection with the Electrical Construction Statute of Washington, to the Public Policy Committee for Washington has been assigned the responsibility for taking suitable action. The Committee believes that the best solution will be found in the repeal of the act and the promulgation in its stead of the National Electrical Safety Code (with certain modifications) by the Public Service Commission.

Of the objectionable features, a limiting voltage to ground, changed from 5000 to 2900 volts, for supply lines crossing telephone circuits, where stronger construction was specified; an increase in the transverse loading specifications for grades B and C construction, and an increase from No. 8 to No. 6 in minimum sizes of medium and hard drawn bare copper wire allowable for grades A and B, carried particular weight. The result of a survey on these matters by the National Safety Committee and the Bureau was conclusive proof to the former that a revision upward in the requirements was entirely unjustified. The report embodies a recent letter from W. J. Canada to the Bureau of Standards out-

lining commendation of the revisions as a whole while presenting objections to the three rules referred to above.

In the final analysis, the Committee believes that the 1920 edition of the National Electrical Safety Code will, in general, be less drastic than the 1916 edition, with the exception of the three rules previously mentioned. It has certainly been very much simplified in arrangement and clarified as to intent. In its present form, with a few modifications, it could well be used as a basis for a Safety Code which would be workable and not unduly burdensome to the utilities.

ACCOUNTING SECTION REPORT

(Efficient cooperation in the electrical industry is considerably dependent upon the accounting methods used, and their coordination. Following is a part of the report made to the recent convention of the Northwest Electric Light and Power Association by the governing committee of the Accounting Section.—The Editor.)

In this report the committee on statistics and accounts of the National Association of Railway and Utilities Commissioners will be designated the National Committee.

It is our belief that the present intention of the National Committee is to submit such form of classification as it may devise to the various state commissions for approval before rendering its final report to the National Association for adoption. In our opinion, consideration of the National Committee's classification will be facilitated and better results obtained if territorial groups of the various states, similar to that of the Northwest Conference on Public Utility Statistics and Accounts, be effected. We therefore recommend that the National Committee make an effort to have such organizations or conference formed.

In its employment of the idea of uniformity of accounts the National Committee should extend this principle to include corresponding uniformity and standardization of annual report forms and statistical data required.

The titles and arrangement of primary or control accounts are of minor importance as compared with the great advantages to be gained by uniformity. It is assumed that in any event a classification will be devised along modern utility accounting lines, having due regard for the requirements of the various commissions as regulatory bodies and the requirements of the utilities as operating and financial organizations.

The test accompanying any classification proposed should be definite and exact. It is important that uniformity in text as well as in account be secured.

GEO. E. QUINAN, chief electrical engineer, Puget Sound Power & Light Company—

"Most problems are feared only because not understood. If the power company faces a difficult situation in inductive interference, it is time to learn all that can be known about it."

—Northwest Electric Light and Power Association.

It is our belief that it will not be necessary to devise an entirely new and original classification. Several exhaustive studies have recently been made along this line; these should be utilized so far as practicable, to the end that the work of the National Committee be minimized and presentation of a classification for the consideration of the several states be expedited.

Where practicable, the classification prescribed by the Interstate Commerce Commission, as representing a classification in general use by states and certain utilities should be followed. This recommendation is offered, having in mind that developments in accounting practice may make radical departures from the Interstate Commerce Commission's classification desirable in certain instances. We deem it important to obtain reconciliation between Interstate Commerce Commission balance sheet accounts and

those to be prescribed by the National Committee.

The preparation of a Uniform Classification of Accounts is now in the hands of a committee of The National Association of Railway and Public Utility Commissioners, The National Electric Light Association and the American Gas Association, and it is our information and belief that the same will be completed so as to make possible its adoption by January 1, 1921.

Accounting departments have advanced to an important place in the affairs of our industry and we are quite sure that within a comparatively short time our profession can refer with much satisfaction to the rapid development made by the Accounting Section of the Northwest Electric Light and Power Association.

J. S. Simpson, Chairman, A. N. Cudworth, R. D. Shepherd, J. F. Denison, G. F. Nevins, C. F. Kirchhaine, A. E. Jannsen, A. B. Doerr, L. W. Dick.

Commercial Section Report

(The commercial side of the central station business constitutes an important field in electrical activities as developed today. A part of the constructive report, presented at the convention of the Northwest Electric Light and Power Association by the governing committee of the Commercial Section, is quoted below.—The Editor.)

Under the new plan providing for the organization of the membership of this Association into four major groups or sections, the Governing Committee of the Commercial Section, comprising nine members, appointed by the president last December, held two regular meetings besides carrying on considerable correspondence regarding matters of more or less interest to the Section and Association.

Undoubtedly the need for commercial emphasis in the central station business fully justifies the creation of a Commercial Section, to say nothing of the value of this arrangement in tying in with the similar plan of the N. E. L. A. parent body.

There is no question but that the central stations of this geographic district have been conspicuously progressive in the development of their business, still it is the opinion of this committee that a greater number of subjects could with profit receive more painstaking consideration in the future than has been the case in the past.

Among the outstanding things which should obviously be placed to the fore for early consideration are power factor rates, improvement in lighting sales, commercial service and relation with customers, electrical salesman's hand book and electrical vehicles; but in particular we wish to call attention to the importance of broad and constructive interest in the matter of an educational committee for practically all classes of our employes, as we feel that our business has grown in dimensions and importance to such an extent that those of us engaged in its various activities do not realize its scope. The development of trained talent for a continued and successful career in this vocation has not kept pace with the demands of the industry to date, and certainly the supply will not be adequate to meet future requirements.

We are of the opinion that a reasonable amount of expense, if necessary, would be justified in provid-

ing central facilities for the coordination of this information for the use of the membership of this Northwest territory, where the problems embraced in our business are in many respects distinctly different from those elsewhere.

The following matters appear to us to be of sufficient importance to be made the subject of special investigation and compilation:

1. Data as to comparative costs of competitive or substitutive forms of service.
2. Methods employed in all departments of our business which have proven to be successful in promoting a higher degree of efficiency.
3. Rate increases that have been secured and theories that have been successfully advanced in the efforts that have been made to secure increases.
4. Ways and means that have been adopted whereby gratuitous service has been eliminated and revenues have thereby been increased.
5. Educational campaigns that have been conducted with particular reference to revenues either through a decrease in operating expenses or an increase in charges.
6. Campaigns for the sale of securities among our customers.
7. General method of establishing demand where the rates are based on the demand.
8. General policy towards the furnishing of special transformers for special devices.
9. Line of demarkation that should be established between transmission line and distribution line, with special reference to the maximum voltage at which company should be prepared to furnish service to rural consumers at standard rates adjacent to the line.
10. Whether new customers requesting service at this time should pay an increased cost over what is paid by the old customers. This question is predicated on the fact that customers must be made to realize that increased use of utility service involves increased costs for many years to come.
11. Data as to abolishing costs between different classes of service so that all our central stations will have a better understanding of the costs of the main types of service such as power, residence lighting, commercial lighting, street lighting, cooking and water heating.

The above have been informally selected from the many things of a like nature the Committee has had under consideration and no doubt any reasonably well versed central station man could make from



At the extreme left is W. D. McDonald, Seattle representative of the Westinghouse Electric & Manufacturing Company. No, we don't know what he has behind his back. The uproarious gentlemen in the second picture are A. C. McMicken, sales manager for the Portland Railway Light & Power Company, and J. I. Colwell, Western Electric Company, Seattle. The photographer asked them to look pleasant.

The contented expressions of the leaning gentlemen are typical of how people felt at convention. The owners of these particular specimens are W. R. Putnam, vice-president of the Idaho Power Company, and H. L. Bargion of the Washington Electric Supply Company, Spokane. Markham Cheever, extreme right, chief engineer of the Utah Power & Light Company, looks like a man of one idea, but made able contributions to the technical discussions as well as to the golf contest.

twenty-five to fifty additions embracing matters upon which we need additional practical information, all of these being matters that are common to most of the companies and in connection with which we are ambitious to establish uniform practice as a fundamental necessity in order to render the most satisfactory and efficient service to the public.

In closing this report it is desired to state that as over half the members of this Committee were members of the Advisory Committee on the cooperation of electrical interests, this latter report was given the right of way and completed for presentation at this convention.

It is our belief that the plan submitted for cooperation, if adopted, will provide the machinery whereby all of the electrical interests such as dealers, contractors and manufacturers, will be able to cooperate with the central stations to the fullest extent and will result in a long step forward in the attainment of the highest ideals of electric service as a whole to the public.

J. V. Strange, Pacific Power & Light Co., Portland; A. C. McMicken, Portland Railway Light & Power Co., Portland; J. S. Groo, Northwest Electric Co., Portland; W. R. Putnam, Idaho Power Co., Boise; J. Ryan Gaul, Montana Power Co., Butte; R. F. Bailey, Utah Power & Light Co., Salt Lake City; J. F. Farquhar, Washington Water Power Co., Spokane; C. P. Cull, West Coast Utilities Co., Seattle; R. W. Clark, Puget Sound Power & Light Co., Seattle, Chairman.

COMPLETE REGISTRATION SPOKANE CONVENTION

Allen, S. S., Wash. Water Power Co.,	Garfield, Wash.
Allison, F. D., Wash. Water Power Co.,	Spokane, Wash.
Anderson, H. R., Wash. Water Power Co.,	Spokane, Wash.
Arthur, Guy, Arthur Fowler Co.,	Spokane, Wash.
Aspinwall, C. V., Westinghouse Elec. & Mfg. Co.,	Spokane, Wash.
Baily, B. P., Pac. Pr. & Lt. Co.,	Astoria, Ore.
Bailey, H. E., Fobes Supply Co.,	Seattle, Wash.
Bargion, Mr. and Mrs. H. L., Wash. Elec. Supply Co.,	Spokane, Wash.
Baughn, Eck,	Yakima, Wash.
Beckman, G. R., Wash. Water Power Co.,	Moscow, Idaho
Bertrand, P. A., Grays Harbor Ry. & Lt. Co.,	Aberdeen, Wash.
Bennett, Lee, Mountain States Power Co.,	Sandpoint, Idaho
Birkett, M. W., Wash. Water Power Co.,	Spokane, Wash.
Bockmier, P. T., Wash. Water Power Co.,	Odessa, Wash.
Bogue, Grace H., Westinghouse Elec. Co.,	Seattle, Wash.
Booth, P. H., Edison Elec. Appliance Co.,	Ontario, Cal.

Boring, Geo. A., Pacific States Elec. Co.,	Portland, Ore.
Batwell, E. N., Puget Sound Power & Light Co.,	Seattle, Wash.
Boykin, A. M., North Coast Power Co.,	Portland, Ore.
Brewer, C. M., Mountain States Pr. Co.,	Albany, Ore.
Brockett, Mr. & Mrs. Norwood S., Puget Sound Pr. & Lt. Co.,	Seattle, Wash.
Brownell, F. W., Puget Sound Power & Light Co.,	Seattle, Wash.
Campbell, Mr. & Mrs. C. B., Rainier Elec. Co.,	Seattle, Wash.
Canada, Chas. E., General Elec. Co.,	Portland, Ore.
Carpenter, H. V., State College,	Pullman, Wash.
Carroll, R. S., Portland Ry. Lt. & Pr. Co.,	Portland, Ore.
Carty, H. H., Spokane Cent. Htg. Co.,	Seattle, Wash.
Chamberlain, R. G., Hurley Machine Co.,	Seattle, Wash.
Cheever, Markham, Utah Power & Light Co.,	Salt Lake City, Utah
Childe, R. B., Intermountain Power Co.,	Seattle, Wash.
Clark, R. W., Puget Sound Power & Light Co.,	Seattle, Wash.
Clark, Walter C., Bunker Hill & Sullivan Mfg. Co.,	Kellogg, Idaho
Cobban, R. J., Westinghouse Elec. & Mfg. Co.,	Butte, Mont.
Coldwell, O. B., Portland Ry. Light & Pr. Co.,	Portland, Ore.
Colwell, J. I., Western Electric Co.,	Seattle, Wash.
Coman, W. E., Wash. Water Power Co.,	Spokane, Wash.
Cone, Donald I., Pac. Tel. & Tel. Co.,	San Francisco
Crawford, M. T., Puget Sound Pr. & Lt. Co.,	Seattle, Wash.
Crowell, B. J., Wash. Water Power Co.,	Davenport, Wash.
Cudworth, A. N., Northwestern Elec. Co.,	Portland, Ore.
Cull, C. P., Northwest Elec. & Water Works,	Seattle, Wash.
Curran, S. R., Curran Sign Co.,	Spokane, Wash.
Currie, W. J., Wash. Water Power Co.,	Spokane, Wash.
Daniels, R. S., Wash. Water Power Co.,	Spokane, Wash.
Davidson, R. J., Pacific Pr. & Lt. Co.,	Portland, Ore.
Davis, R. E., Pacific Power & Light Co.,	Portland, Ore.
Doerr, A. B., G. H. Light Company,	Aberdeen, Wash.
Donald, J. C., B. C. & Alta, Pr. Co. Ltd.,	Fernie, B. C.
Downing, R. A., Okanogan Valley Power Co.,	Brewster, Wash.
Drew, Hal R., Duplex Lighting Works,	Seattle, Wash.
Edwards, L. W., Coast Power Co.,	Tillamook, Ore.
Enloe, Mr. & Mrs. Raymond, Okanogan Valley Power Co.,	Okanogan, Wash.
Enlope, Mr. & Mrs. Eugene, Okanogan Valley Power Co.,	Spokane, Wash.
Faulkner, L. B., Olympia Light & Power Co.,	Olympia, Wash.
Farquhar, Mr. & Mrs. J. F., Wash. Water Power Co.,	Spokane, Wash.
Finley, J. G., Wash. Water Power Co.,	Spokane, Wash.
Fiskin, Mr. & Mrs. John B., Wash. Water Pr. Co.,	Spokane, Wash.
Florine, F. N., Pacific Pr. & Lt. Co.,	Sunnyside, Wash.
Foster, Chas. S., Wash. Water Power Co.,	Spokane, Wash.
Fredericks, T. W., N. W. Elec. Equipment Co.,	St. Paul, Minn.
Gates, S. E., Gen. Elec. Co.,	Spokane, Wash.
Gille, H. J., Puget Sound Power & Lt. Co.,	Seattle, Wash.
Grant, L. R., Puget Sound Power & Light Co.,	Seattle, Wash.
Gray, Henry L., Consulting Engineer,	Seattle, Wash.
Greisser, V. H., Wash. Water Power Co.,	Spokane, Wash.
Griffith, F. T., Portland Ry. Lt. & Pr. Co.,	Portland, Ore.
Groo, Jay S., Northwestern Elec. Co.,	Portland, Ore.
Grunsky, Mrs. C. E.,	San Francisco
Grunsky, Miss Clotilde, Journal of Electricity,	San Francisco
Haggmiller, A. C., Wash. Water Power Co.,	Spokane, Wash.
Hamilton, W. M., Portland Ry., Lt. & Pr. Co.,	Salem, Ore.

H. R. WAKEMAN, Portland Railway Light & Power Company—

"The solution of the inductive interference problem, as that of merchandising, is cooperation."

—Northwest Electric Light and Power Association.

Harper, Mr. and Mrs. W., Chelan Elec. Co.	Chelan, Wash.	Phillips, L. L., Pac. Tel. & Tel. Co.	Portland, Ore.
Harlan, R. G., Elec. Equipment Co.	Walla Walla, Wash.	Putnam, W. R., Idaho Power Co.	Boise, Idaho
Harris, Mr. & Mrs. D. E., Pacific States Elec. Co.	San Francisco	Putraw, P. A., Rainier Elec. Co.	Seattle, Wash.
Henkle, J. C., Portland Ry., Lt. & Pr. Co.	Portland, Ore.	Quinan, G. E., Puget Sound Pr. & Lt. Co.	Seattle, Wash.
Hepler, S. G., Arrow Elec. Co.	Seattle, Wash.	Rogers, H. B., Pacific States Elec. Co.	Spokane, Wash.
Holsey, T. E., Wash. Water Power Co.	Spokane, Wash.	Royer, J. E. E., Wash. Water Power Co.	Spokane, Wash.
Hungate, J. W.	Spokane, Wash.	Safford, L. W., Pac. Pr. & Lt. Co.	Kennewick, Wash.
Hunt, Earl R., Wash. Water Power Co.	Spokane, Wash.	Sansom, W. W., Portland Ry. Lt. & Pr. Co.	Portland, Ore.
Husbands, Mr. & Mrs. Richard H., Pacific States Elec. Co.	Seattle, Wash.	Sawyer, Geo. C., Pac. Pr. & Lt. Co.	Yakima, Wash.
Hynes, W. F., General Elec. Co.	Portland, Ore.	Schoolfield, H. H., Pac. Pr. & Lt. Co.	Portland, Ore.
Irwin, A. F., Wash. Water Power Co.	Moscow, Idaho	Scott, W. A., Elec. Review	Portland, Ore.
James, D. H.	Spokane, Wash.	Scott, W. D., The Pac. Tel. & Tel. Co.	Seattle, Wash.
Jennings, P. D., Puget Sound Power & Light Co.	Seattle, Wash.	Scott, W. L., Wash. Water Power Co.	Spokane, Wash.
Janssen, A. E., Idaho Power Co.	Boise, Idaho	Sears, Geo. C., Puget Sound Pr. & Lt. Co.	Seattle, Wash.
Johnston, W. A.	Spokane, Wash.	Sebern, Millard, Wash. Elec. Supply Co.	Spokane, Wash.
Jones, W. E., Economy Fuse & Mfg. Co.	Seattle, Wash.	Shields, F. M., Rathdrum Elec. Co.	Spokane, Wash.
Kennedy, Miss Don.	Spokane, Wash.	Shortley, A. L., Inland Elec. Co.	Spokane, Wash.
Kerns, B. L., Westinghouse Elec. & Mfg. Co.	Seattle, Wash.	Shreve, Lewis M., Wenatchee Valley Gas & Elec. Co.	Wenatchee, Wash.
Kinder, J. F., The Universal Electric Co.	Ohio	Smallidge, F. E., Elec. Supply Co.	Wenatchee, Wash.
Kinkaid, J. M., Northwestern Power & Mfg. Co.	Port Angeles, Wash.	Sibley, Robert, McGraw-Hill Co.	San Francisco, Cal.
Kirchhaine, Mr. & Mrs. F., Puget Sound Int. Ry. & Pr. Co.	Everett, Wash.	Siefried, J. H., Pac. Pr. & Lt. Co.	Kennewick, Wash.
Kirschberg, Hamilton Beach Mfg. Co.	Racine & New York City	Simpson, J. S., Wash. Water Power Co.	Spokane, Wash.
Klehm, H. L., Wash. Water Power Co.	Tekoa, Wash.	Simpson, L. M., Deschutes Power Co.	Spokane, Wash.
Knowles, C. S., Pac. Pr. & Lt. Co.	Kennewick, Wash.	Shiwyer, W. C., Deschutes Power Co.	Spokane, Wash.
Leigh, H. R., Puget Sound Pr. & Lt. Co.	Seattle, Wash.	Slocum, J. B., Edison Lamp Works of G. E.	Spokane, Wash.
LeFever, Mr. and Mrs. O., Northwest Elec. Co.	Portland, Ore.	Stafford, Rex T., Allis-Chalmers Mfg. Co.	Seattle, Wash.
Lewis, J. D.	Wilbur, Wash.	Steel, Miles F., Benjamin Elec. Mfg. Co.	San Francisco
Lewis, Lewis A., Wash. Water Power Co.	Spokane, Wash.	Steelquist, R. U., Mountain States Power Co.	Albany, Ore.
Lindsay, S. C., Puget Sound Pr. & Lt. Co.	Seattle, Wash.	Strange, John V., Pac. Pr. & Lt. Co.	Portland, Ore.
Lindsley, E. A., The Lindsley Bros. Co.	Spokane, Wash.	Talbot, Guy W., Pacific Pr. & Lt. Co.	Portland, Ore.
Martin, A. A., Western Elec. Co.	Spokane, Wash.	Thatcher, R. E., Puget Sound Pr. & Lt. Co.	Seattle, Wash.
McArthur, Lewis A., Pacific Pr. & Lt. Co.	Portland, Ore.	Tinkham, H. J., Pac. Tel. & Tel. Co.	Portland, Ore.
McCain, Mahlan, Flathead Valley Elec. Co.	Spokane, Wash.	Tinling, Hugh L., Hutton-Tinling Elec. Co.	Spokane, Wash.
McDonald, Alice G., Westinghouse Elec. & Mfg. Co.	Seattle, Wash.	Tompkins, R. E., Wash. Water Power Co.	Colfax, Wash.
McDonald, W. D., Westinghouse Elec. & Mfg. Co.	Seattle, Wash.	Turnbull, Ray W., Edison Elec. Appliance Co.	Portland, Ore.
McDonald, D. T., Westinghouse Elec. & Mfg. Co.	Seattle, Wash.	Turner, H. W., Wash. Elec. Supply Co.	Spokane, Wash.
McElroy, R. B., Wash. Water Power Co.	Spokane, Wash.	Van Riper, H. T., Edison Elec. Appliance Co.	Seattle, Wash.
McGrath, W. H., Puget Sound Pr. & Lt. Co.	Seattle, Wash.	Voellmeck, J. W., Kootenai Power Co.	Coeur d'Alene, Idaho
McHugh, W. E., Okanogan Valley Power Co.	Spokane, Wash.	Wakeman, Mr. and Mrs. H. R., Portland Ry. Lt. & Pr. Co.	Portland, Ore.
McKissick, D. C., Northwestern Lt. & Pr. Co.	Wallace, Idaho	Wallis, C. R., General Elec. Co.	Seattle, Wash.
McMicken, A. C., Portland Ry., Lt. & Pr. Co.	Portland, Ore.	Welch, J. G., Westinghouse Elec. & Mfg. Co.	Seattle, Wash.
McNair, J. S.	Spokane, Wash.	Whitehouse, H. G., Wash. Elec. Supply Co.	Spokane, Wash.
McWilliams, J. A., Wash. Water Power Co.	Ritzville, Wash.	Williams, H. R., Stevens County Pr. & Lt. Co.	Colville, Wash.
Meacham, W. M., Meacham & Babcock	Seattle, Wash.	Wilson, G. L., Wash-Idaho Water, Lt. & Pr. Co.	Lewiston, Idaho
Melvin, H. L., Wash. Water Power Co.	Spokane, Wash.	Wollaber, Mr. and Mrs. A. B., So. Cal. Edison Co.	Pasadena, Cal.
Mendenhall, H. E., Little Spokane Pr. & Lt. Co.	Deer Park, Wash.	Worth, Roy, Pacific States Elec. Co.	Seattle, Wash.
Mendenhall, Mark F., Little Spokane Lt. & Pr. Co.	Deer Park, Wash.		
Miller, A. A., Westinghouse Elec. & Mfg. Co.	Seattle, Wash.		
Miller, W. T., Wash. Water Power Co.	Spokane, Wash.		
Monges, R. F., General Elec. Co.	Portland, Ore.		
Morrill, R. H., Wash. Water Power Co.	Pullman, Wash.		
Moon, V. H., Pac. Pr. & Lt. Co.	Pendleton, Ore.		
Moore, R. J., Yamhill Elec. Co.	Newberg, Ore.		
Morse, L. E., Wash. Water Power Co.	Spokane, Wash.		
Moss, J. W., Wash. Water Power Co.	Spokane, Wash.		
Myers, Geo. L., Pac. Pr. & Lt. Co.	Portland, Ore.		
Neill, Thomas W., Kootenai Power Co.	Coeur d'Alene, Idaho		
Nims, F. D., Wash. Coast Utilities	Seattle, Wash.		
O'Dea, M. L., Wash. Water Power Co.	Spokane, Wash.		
Olsen, Bernhard, General Elec. Co.	Spokane, Wash.		
Olson, Emil V., Wash. Water Power Co.	Spokane, Wash.		
Onken, W. H., Jr., Electrical World	New York, N. Y.		
Orr, J. F., Idaho Power Co.	Payette, Idaho		
Osborne, C. P., Portland Ry. Lt. & Pr. Co.	Portland, Ore.		
Peters, W. E., Western Elec. Co.	Spokane, Wash.		
Peterson, E. V., Westinghouse Elec. & Mfg. Co.	Seattle, Wash.		
Phelps, Fred G., California-Oregon Pr. Co.	Medford, Ore.		



Lewis A. Lewis, commercial agent of the Washington Water Power Company, and secretary of the Northwest Electric Light and Power Association, is shown cooperating with Mrs. Lewis in looking as natural as possible. Mr. Lewis' specialty is cooperating, and to his active work, both in the convention and in the commercial field of his company, is due much of the success of merchandising in the Northwest. The gravity which H. H. Manny, Seattle representative of the Baker-Joslyn Company, is nobly trying to preserve, is made somewhat difficult by the irresistible joviality of H. W. Turner, Washington Electric Supply Company, Spokane.

ENGINEERS OF YESTERDAY

By A. L. Jordan

21. Prony.

What is the simplest appliance for measuring the horsepower of an engine?

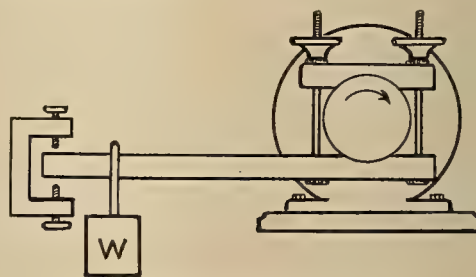


Diagram of the friction brake

Baron Gaspard Clair Francois Marie Riche de Prony (1755-1839) was a famous French engineer. He became Professor of Mathematics at one engineering school, and later the director of another, was engaged in important work such as the protection of certain districts from river flood-waters, became a Baron in 1828, a Peer in 1835 and yet we would never have heard of him but for his invention in 1800 of the useful friction brake. This was originally two wooden beams clamped to the engine shaft, a known weight which could be moved along the arm of one beam, and some means of finding the revolutions per minute of the shaft. From these quantities the "brake horsepower" could be determined. Many improvements (means of carrying away the heat produced, of preventing vibration, etc.) have been made, notably those by Poncelet, Lord Kelvin, James Thomson, Alden, and Ayrton & Perry; Froude and Reynolds have invented water brakes for large engines; but the most recent development is the use of the extremely convenient "magnetic friction" of the electric transmission dynamometer, the appliance now used by some of the leading automobile builders in their testing laboratories.

Pole Preservation

BY W. M. LEAVITT

(The durability of poles is a subject which directly affects the electrical industry, as well as being an important factor in timber conservation. The following paper on the subject was delivered by the secretary of the Western Cedar Pole Preservers' Association at the recent convention of the Northwest Electric Light and Power Association at Spokane.—The Editor.)



Timber is one of the country's most important natural resources, and its conservation is a vital economic question.

THE United States has reached a point in its development where an unnecessary waste of its natural resources is a matter of first importance to every good citizen. The science of treating wood to prevent deterioration has had a wonderful development in the last fifteen years, and is now recognized by all large users of forest products as an important factor in the conservation of our timber supply. The members of the Western

Red Cedar Association have spent much time and money in personal investigation and experiments, and have cooperated at all times with the United States Forestry Service through its laboratory at Madison, Wisconsin, and with the National Electric Light Association.

The Forestry Department has conducted extensive experiments for the purpose of determining the increase that could be expected in the life of poles treated by different methods.

Technical Note No. 100, of the Forest Products Laboratory, Madison, Wisconsin, reads as follows:

"Light Creosote Oil properly injected into wood apparently will prevent decay until the wood wears out, or until it checks so badly that the untreated portions are exposed. That is the indication of service records collected by the Forest Products Laboratory on Railroad Ties and Telegraph Poles preserved with low boiling creosote."

The first treatment extensively used was the brush treatment which resulted in no penetration whatever.

First Treating Plant Established

The first commercial plant established for treating poles was for the purpose of giving a dip treatment which consisted of a fifteen to thirty-minute immersion in a high boiling creosote oil heated to 112 to 140 degrees Fahrenheit. When poles were properly seasoned, this method resulted in a certain degree of satisfaction, but many of the poles treated by this method showed no penetration at all, and in no instance was the penetration sufficient to be any insurance against abrasion from handling or from checks occurring after treatment. This method is now known under Western Red Cedar Association Treating Specifications as treatment "A." The same process, using a lower boiling creosote oil is known as treatment "AA."

The open tank method which consisted of immersion in a comparatively low boiling creosote oil

heated to 212 degrees to 240 degrees Fahrenheit for from four to twelve hours, followed by immersion in cold oil for from two to twelve hours, did not come into general use until about four years ago. This method is designated in Western Red Cedar Association Treating Specifications as treatment "B." Experience has shown that where poles have been seasoned for two years or more, a very satisfactory penetration can be obtained on a large percentage of the poles treated by the "B" method. It was found, however, that there was a certain percentage of poles, no matter how well they were seasoned, that the oil would not penetrate.

Development of Puncturing Method

One of our members conceived the idea of overcoming this difficulty by puncturing the sap wood of the poles with short steel points. He used a



A treating plant at Sandpoint, Idaho. The new "puncture treatment" ensures penetration of at least half an inch even in green wood, without affecting the strength of the pole.

rubber belt eight inches wide and three feet long, and arranged the points so that a perfect penetration would be obtained if the oil traveled lengthwise of the poles two and one-half inches, and crosswise an eighth of an inch. This was a distinct improvement, and during the last two years a number of the treating plants have been puncturing all poles that they have treated by the "B" method. Difficulty was experienced, however, in getting a sufficiently deep puncture as the points had to be driven in with wooden hammers, and as this work was done by hand

A. C. McMICKEN, sales manager, Portland Railway Light & Power Company—

"The adoption of the report of the Advisory Committee on Cooperation is the most important step taken by the electrical industry of the Northwest in recent years."

—Northwest Electric Light and Power Association.

there was no assurance that the work was being properly performed.

About two years ago, we shipped into the Sandpoint Treating Plant for experimental purposes one carload of green poles, one carload of poles that had been seasoned twelve months, and one carload of poles that had been seasoned over two years. A number of the members of our Association who were interested in treating spent nearly a week at Sandpoint on these experiments.

The results of these experiments may be summarized as follows:

1. That, if the sap wood was properly punctured, a full sap penetration could be obtained in either a green or a seasoned pole.

2. That it was impossible by the use of steel points in a belt to puncture the sap wood of a pole in a proper and uniform manner.

3. That, where poles were not punctured there was no uniformity of results on either seasoned, partly seasoned or green poles. A considerable difference in the depth of penetration obtained, was often found on the same pole. Very few of the green poles or poles cut twelve months or less showed a penetration of over an eighth of an inch.

It was the unanimous opinion of those interested that in order to get a proper penetration a machine must be built that would properly puncture the sap wood. It took some time to conceive the plans for such a machine and have it built, and we did not get it running until about three months ago.

A Satisfactory Puncturing Machine

During the last three months all poles given the "B" treatment at the Sandpoint Plant have been

punctured by the machine, and careful observation during that time would indicate that we are now in a position to guarantee that every pole will have a penetration of at least one-half inch.

A number of changes had to be made in this machine, and a new one incorporating these changes is being built at the present time, but the results obtained by using the first machine have demonstrated beyond a doubt that any penetration desired up to a full sap penetration can be obtained by using the proper size of puncture point.

We feel that this is an important achievement both for the cedar pole industry and for all users of cedar poles, as it is now a recognized fact that the depth of penetration has a direct influence upon the durability of the pole.

On the present basis of prices, the treating price of an 8-in. 40-ft. pole represents approximately 30% of the price of this pole delivered on a 30c. freight rate, 25% when delivered on a 50c. freight rate, and 20% when delivered on a 70c. freight rate. When you add to the original delivered price of your pole the cost of hauling and setting, the percentage of increase in the original cost on account of treating is really very small.

From the point of view of conserving our forest products the proper treatment of poles is a duty, and from an economic point of view measuring the value received for money expended, permanency of investments, and dividends, the proper treatment of poles is a necessity.

Reminiscences of Power Development on the San Joaquin

BY A. G. WISHON

(Running transmission lines into the wilderness, staking a fortune on its possibilities for development, venturing into the oil fields—these are but items in the early romantic history of the San Joaquin Light & Power Corporation, in its daring pioneer days. This is the second half of the story by its general manager.—The Editor.)

The load had already grown so that we had installed a 750-hp. Mackintosh and Seymour engine, which was the pride of Fresno, and that year we were forced to install a 350-hp. additional steam unit, to carry the load over the low season of water flow; but as it would be only a standby plant and presumably not needed except during low water flow, it was thought best to buy a second-hand engine that we found at the Union Iron Works, of a vertical, marine type. The load grew, however, to such an extent that notwithstanding the No. 3 Power Plant, that had 2500 kw. capacity, we were again obliged to bring this engine into action in 1907 during the low water season, when it blew the upper cylinder out through the roof of the power house without other accidents than coming down through the wire circuits that left the substation. These were easily repaired in the course of a day or two, but for a month or two we were very short of power.

To get through the next year, we raised the bulkhead a little higher in the spillway of the reservoir and filled the reservoir four or five feet deeper—which caused the earthen dam to saturate and the

management to lie awake nights, expecting the dam to go out every minute.

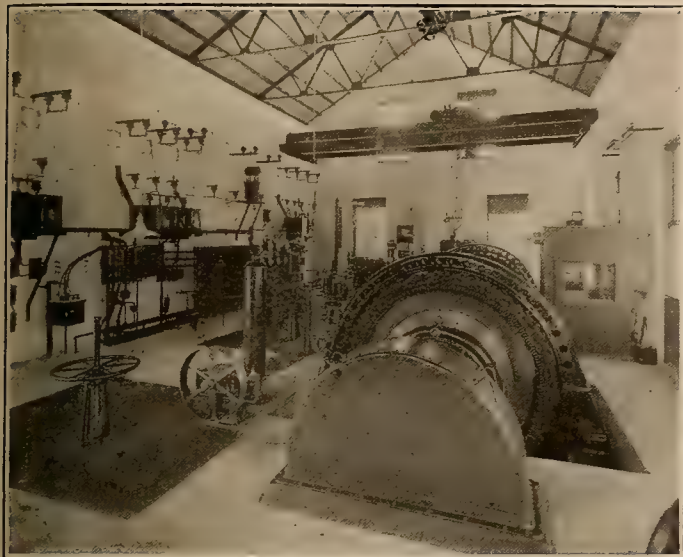
Growing Pains

After the panic of 1907 finances began to get better and the load heavier, and we then arranged



Power House No. 3 of the San Joaquin Light & Power Corporation was built in 1910 and was one of the first of five power houses now under the Crane Valley Reservoir.

for the building of the present Crane Valley reservoir. During the construction we enlarged the old No. 1 Power House from 1450 to 16,000 kw., but were again confronted with the serious problem of running the water in the old ditch while we made it



Power House No. 3 of the San Joaquin Light & Power Corporation equipped with Bullock 1000-kw., 3-phase, 550-volt generators. The armatures are Y connected with ground neutrals. The exciters are 6-pole, 125-volt d.c. generators mounted on the generator shaft between the generator and main bearings.

big enough to carry water for the new power house. The question as to how it would be accomplished was the subject for serious discussion of all the engineering talent that had been employed on the whole big job, but finally we agreed upon a plan and the desired results were accomplished.

About that time we took over the Power Transit and Light Company at Bakersfield, with its gas works, inadequate for the demands upon it; its railroad (single track and without ballast); its second-hand, antique type of cars, from San Francisco's earliest effort in that line; and with the power plant fifty per cent overloaded and no steam relay. Plans were formulated to build a 60,000-volt line down the west and east side of the valley, going via the "big west side" and the oil fields of McKittrick, Midway, and Maricopa, with the ultimate purpose of building another line down the east side of the valley, so as to utilize the capacity of the Tule River Plant as soon as it could be completed. The condition at Bakersfield was so desperate that we at once arranged with the General Electric Company to loan us a 750-kw. second-hand turbo-generator set, while we could take time to get through their shop the delivery of a new 2000-kw. set, the idea being to settle the steam plant troubles once and for good. But the first day we had charge of the Power Transit & Light plant one of the overloaded units in the Kern Canyon Power House burned out and deprived us of one-third of our capacity. Therefore, the town of Bakersfield went without street lights until we could get the borrowed steam unit installed, and finally, a week before the new plant was completed the borrowed plant burned to the ground.

We took over all of the employees that were then working for the plant, that we could possibly use.

One of the employees, in a very important position, who seemed particularly capable and whom we planned to make a permanent part of our organization, in the course of a month tendered his resignation. By stealthy methods we learned that his reasons for leaving were based upon his theory that the Power Transit & Light Company were barely "getting by" with their old pay roll, and that we were all certain to "go to the wall" with the additions that we had made to it.

In the following two years we expended in Kern county more than two and a half million dollars, and were taking in from the oil fields and pump irrigation that the old company had never attempted to develop, more money than the total plant was earning when we bought it. A gas line was built some fifty miles to tap a natural supply from the Midway Oil Fields, and we spent as much more money in the extension of the gas works as the old company had invested in it, increased the number of consumers to twenty times what they were selling, notwithstanding that we reduced the price to one-third of what



Mountain pole line from old "San Joaquin" Plant No. 1 to Fresno, a distance of 35 miles. At the time it was built this was considered the longest high tension line in existence. It carried two 30,000-volt lines and a service telephone line.

H. J. GILLE, sales manager, Puget Sound Power & Light Company —

"Standardization is a good thing but it should not be permitted to impede progress nor unduly affect economy."

—Northwest Electric Light and Power Association.

they were getting. We also double-tracked and paved the street railway and provided it with modern cars, thereby increasing the service as well as the income.

Pioneering in the Agricultural Districts

Merced was equipped with a hydro plant at Merced Falls, with a capacity of 350 hp. when the river was up and 100 hp. when the river was low. It was backed by a 225-hp. steam generator, located in Merced, to help out in the low water season, but in a short time we extended our 33,000-volt line, which had already been built as far as the city of Madera, thirty-five miles farther to Merced, and started in on a development of the country business, which up to that time had not a single motor operating. Literally thousands of pumping plants are now operating in both Merced and Kern counties, far away from the town that formerly had the only available electricity.

A line was then extended from near Madera up through the big Miller & Lux ranch to Los Banos, but not until the management had gone over the country many, many times, and had given great consideration to the possibilities of development in a country covered by a big ditch system. I do not think we could have built then but for the public pressure that was brought to bear upon us. Our faith in the amount of heavy business that could be developed can be measured by the fact that we took the smallest wire that we have ever used on any extension to cover that district, believing that we were making a hazardous movement in covering that territory. Our estimates of income were exceeded one hundred per cent the first year and more than that for every subsequent year. Our entrance into the town and the turning on of the current was the signal for a public celebration and a big parade, in which the manager and his wife were invited to ride in the front automobile. A banquet and dance followed, with all the good things that go to show the appreciation of a really thoughtful and thankful people for a commodity so necessary to human existence. This line, of course, has long since had to be replaced by one of larger capacity and the voltage changed to 60,000. The possibilities up there, as elsewhere, have scarcely been scratched.

The little steam plants at Selma, Sanger, and Madera had already been junked and our system extended to cover those districts; and we now look back with amazement to the time when Dinuba, Reedley, Selma, Sanger, and Madera were carefully considered as worth \$300 each per month income, and take satisfaction in comparing this with the many thousands that we are getting out of those districts today.

In the Oil Fields

The late John A. Bunting owned a steam-driven lighting plant in Coalinga; every joint of pipe was leaking steam and every generator was loose on its foundations and the old wooden buildings were nearly ready to fall down. It was more than forty miles straight across the plains from Lemoore, which

seemed to offer about as much business as crossing a bridge. After much negotiation we secured control of this "bunch of junk," and by a separate company we took the chance of crossing those plains and that bridge to reach the town of Coalinga and the Coalinga Oil Fields, with the principal view of making an experiment in oil field operation. Pumping oil out of the ground in an oil field, with no freight on the oil and considerable waste in natural gas in the field, probably did not look very conservative to a banker who was supposed to know all about financing utilities, but it was these oil fields that suggested the necessity of a variable speed, induction type motor, that was the means of bringing a new and great industry to electric operation. The results of the operation of that motor and of oil development by electric power is a matter with which all are more or less familiar, and the future possibilities when additional power is available in that line are almost beyond conception.

Past, Present and Future

The Tule River Plant was then completed, 11,000 kw. in steam was added to the Bakersfield Steam Plant, No. 2 Power House, Crane Valley and No. 1-A Power Plants completed, and a 12,500-kw. steam unit is now being added to the Bakersfield plant; the big Kerckhoff 30,000-kw. plant was completed in August; plans are out and part of the equipment ordered for the first unit of the Midway Steam Plant, that we expect will have at least 50,000 kw., while we are getting ready for the construction of 200,000 kw. on Kings River.

Many new and successful departures from standard construction have been inaugurated and operated by the San Joaquin, I believe, as pioneers; namely, outdoor type of substations, pole lines with 584-ft. spans, canyon lines of nearly 3000-ft. spans; split steel, angle type cross-arms; completely welded gas lines, that were installed in sections of 1500 ft. each, and many other changes from the ordinary practice of construction.

San Joaquin's income has grown from \$10,000 a month at the beginning to more than \$300,000 a month today. Their consumers have grown from 800 in 1903 to 46,000 in 1919; from two towns in 1903 to about one hundred and twenty-five towns in 1919; from the two counties to ten counties, covering a territory four-fifths as large as the state of New York; and a farming community comprising an irrigable area that will require irrigation by pumps for more than two million acres and including more than three-quarters of all the oil fields in California.

The management of the San Joaquin has often been charged by conservatives as visionary—but in looking back we are forced to the conclusion that we were dull not to have better understood the possibilities of development that have been unreeling during the last twenty odd years. We thought we had the vision, but now we see that the results are four to ten times above our fondest dream, and we believe now that it would be a daring dreamer who would predict in writing the situation as it will exist ten years hence.



Arch dam on Santa Inez River recently completed to provide additional water storage for Santa Barbara

The Construction of the Gibraltar Dam

BY N. A. BOWERS

(Every construction job entails enough "grief" such as delay in delivery of material, breakdown of equipment, bad weather, etc., without adding to these the necessity for bringing everything needed through a 4-mile hole not high enough to stand in and running knee deep in water. However, contractor Kraner overcame the many difficulties of such a problem and finished the Gibraltar dam on schedule. He is to be complimented and the city of Santa Barbara congratulated on the completion of a piece of work which is a credit to all concerned.—The Editor.)

On the Santa Ynez river about six miles east of the city of Santa Barbara that city has recently completed the construction of an arched masonry dam to provide additional storage for its water system. The site is on the far side of a high mountain range over which no roads have been built but which is pierced by a small tunnel 4 miles long through which the city receives its water supply.

The problem of building a dam which would provide the desired storage was chiefly a problem of getting equipment and materials to the dam site. The mountain range is very high and precipitous, and to go around by way of the mouth of the river would have meant many miles of road construction. In either of these routes the cost would have been prohibitive. The tunnel which was the only other alternative has a clearance of only 42 by 48 in. The city's water supply depends on maintaining a flow through this tunnel which at the time of lowest water is always 12 to 18 in. deep. Not to mention the continuous down pour from the roof in many places. Due to difficulties in driving the tunnel, its alignment is not good. However, these difficulties did not seem insurmountable to the contractors who signed a contract to carry out the work. The contract was made with Bent Brothers and W. A. Kraner, entire charge of the work being left in the hands of the latter.

Transportation through a Tunnel

How well the problem of transportation through the tunnels was worked out, is indicated by the fact that in the first three months of the construction period, 15,000 cu. yd. of concrete were poured in the

dam with but little delay on account of tunnel difficulties. Of course rails were laid and a 220-volt trolley line was strung through the tunnel so trains could be operated electrically, but in order to secure the maximum clearance mentioned, large pieces such as motors, steam shovel boilers, and other equipment that could not be cut apart, had to be taken through on a special low car which was pushed by hand,—a trip requiring from 9 to 11 hours. The operation of the tunnel railway was under the direction of the city of Santa Barbara, the cost to the contractor being \$2.00 per ton laid down beneath an aerial cableway near the dam, 2000 ft. upstream from the far portal.

Trains were operated through the tunnel for 16 hours out of each 24, there being two 8-hour shifts on each train crew. Four electric locomotives were used, of which one was considered a spare, so that three trains were expected to be in service continually. Of these one was ordinarily loading or unloading while the others were enroute. A siding was provided midway in the tunnel so that trains could pass at that point. The average time for a round trip was about an hour, so that with three trains, allowing time for loading and unloading, there would be a trainload delivery at destination every thirty minutes. Cement was taken through in 3-car trains, the

D. L. HUNTINGTON, president, Washington Water Power Company —

"The electrical industry has just passed through the hardest years of its existence but the future is beginning to look more rosy."

—Northwest Electric Light and Power Association.

load being 51 sacks per car. Each car was covered with heavy tarpaulin for protection from leakage from the roof and splashing from the car trucks. At the railway terminal the cars were not unloaded but were picked up bodily from the rails by the cable-way carrier and hoisted across the gorge to the eminence at one end of the dam.

• Equipment in Instalments

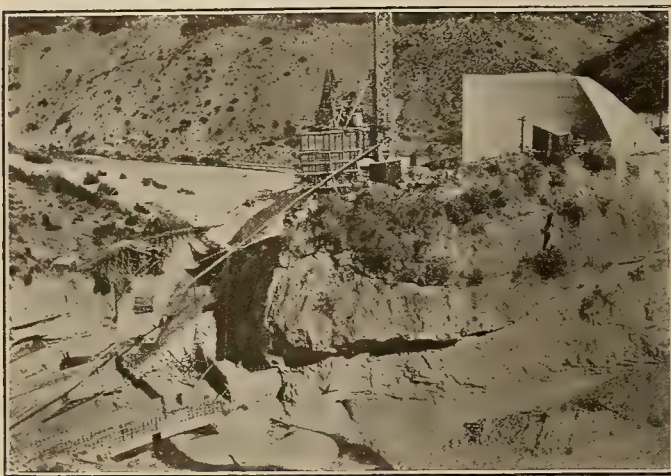
In a little over six weeks there came through the tunnel, piece by piece, two 1-cu. yd. mixers, six electric hoists, rock screens, skips, hoppers, and a steam shovel which the contractor had selected with an eye to the fact that the boiler would just meet the tunnel clearance requirements. Such equipment as

risk of possible leakage into the water supply system from oil transported in barrels. Dynamite the city absolutely refused to permit in the tunnel at all so that this had to go by pack horse over a long, rough trail.

Structural Features

As to the dam itself, it has a total height of 185 ft. above bedrock. The radius on the center line is 238.5 ft., the width varies from 65 ft. at the bottom to 8 ft. at the top and the length measured along the curve is 1100 ft.

Because the south wall of the canyon was not high enough, a 3000-cu. yd. concrete block, triangular in plan, was poured to take the thrust of the arch in



Construction view showing artificial abutment



Construction materials on electric train ready for the tunnel trip

concrete mixers were cut in pieces by an oxyacetylene torch for transportation through the tunnel and were welded together again on the far side. In between the shipments of all this equipment during this 6-weeks period there was also handled through the tunnel 40,000 sacks of cement and 275,000 ft. board measure of lumber. By reason of this expeditious delivery the contractor was able to pour 15,000 cu. yd. of concrete in the first three months, sometimes the quantity being as high as 420 cu. yd. in a single day's run.

The largest assembly job incident to getting the equipment through the tunnel was on the Thew steam shovel. When this shovel was delivered at the end of rail transportation, the miscellaneous collection of parts there assembled had all the general appearance of a wreck. The boiler of course had to go through intact, but practically all the other large parts were dismantled or cut to pieces. Platform and turntable were taken apart, and even the teeth were taken off the bucket. A total of approximately 1000 rivets were cut out in dismantling the shovel and later put back on arrival at the dam.

Of course all this had to be repeated when the equipment was shipped back to the "outside." It is notable that the two large concrete mixers, when finally returned to Santa Barbara, were still in first class serviceable condition after having been twice cut apart and welded together again.

Special tank cars were built for conveying fuel oil through the tunnel, as the city refused to run the

the upper part of the dam on that side. This was placed before the main body of the dam was begun so that it had about a year to set before being expected to carry thrust from the dam proper.

On the side of the artificial abutment, away from the canyon, an extension of the dam structure in a straight line provides a spillway with its top 14 to 13 ft. below the parapet level, and about 300 ft. in length. The capacity of this spillway is about twice the maximum flood on record. Four concrete vanes, parallel with the direction of flow, and just below the rollway, were put in to prevent the current from cutting across toward the deeper portion of the canyon. The vanes have transverse holes at the bottoms so that the pools which serve as a water cushion drain out when overflow ceases.

When the water stands at spillway level, it will be 135 ft. deep behind the dam and will form a lake about $4\frac{1}{2}$ miles long containing 16,000 acre-feet. The intake tower, which is built into the upstream face of the dam, has openings for admitting water at five levels, each opening being controlled by a 16-in. valve operated by a hand wheel from the parapet. Screens for these openings, placed on the outside, operate in grooves made in projecting ribs of concrete. From the intake tower in the dam, water will be conveyed through a $3\frac{1}{2}$ -ft. concrete conduit 200 ft. long to a 900-ft. tunnel. A measuring weir was put in at the lower end of this tunnel so that the quantity of flow could be conveniently gaged when desired. Below the weir 1600 feet of 3-ft. reinforced concrete pipe

connect the line with the north portal of the four-mile tunnel.

Rock and sand for the dam were obtained from deposits in the stream bed just above the site by a steam shovel, and were loaded in 6-cu. yd. cars which were hauled by a gasoline locomotive to the crushing and screening plant located in the river bottom 200 ft. upstream from the face of the dam. After crushing, screening and washing, the aggregate was transported by a 1½-cu. yd. automatic dumping bucket running on a 1½-in. cable to rock and sand bins on the hill above. The location of these bins and the mixing plant and tower with them was given considerable thought because of the necessity for reaching all parts of the curved structure conveniently from the one point of delivery. By building a 185-ft. tower on top of the south wall of the canyon it was possible to get ground anchorages for cables supporting chutes through which high gravity delivery was made to all parts of the work with only one change of the cable anchorage. The chutes were set on an angle of about 3 to 1, and delivery was made for a distance of 400 ft. each way from the tower.

Pouring the Concrete

Before concreting was started a reserve supply of 32,000 sacks of cement was brought through the tunnel and stored in a warehouse near the damsite. When concrete was under way the cars carrying 50 sacks each were picked up bodily as they arrived and transported across the canyon to the mixing plant by means of a cableway described on page 443 of the *Engineering News-Record* for February 27, 1919. The concrete was mixed and delivered to a 30-cu. ft. skip in capacity loads at the rate of one batch per minute; this rate being continued for long stretches

at a time without interruption and without cutting the time of mixing below 30 seconds for each batch. Seven men were used in the mixing crews, assigned as follows: one man operating bin gates, one man dumping water, operating mixer and giving signals, two men unloading cement from cars, two men dumping cement from sacks into charging hopper, and one man bundling up and tying empty sacks.

A total of 54,000 cu. yd. was poured in spillway and dam (above streambed level). The work was completed and accepted in 18 months, although during 5 months of this time no work was carried on. The stoppage was deemed advisable because during the winter months the rock and sand deposits were ordinarily covered by high water. The contractor was particularly careful in securing alignment of the dam faces during construction, the result being that at no place on the dam is variation from true line greater than one inch. As a result of careful proportioning of the aggregates and handling of the concrete, the exterior surfaces are notably free from irregularities and voids.

When concreting was started a 4 x 6-ft. opening was left in the lowest portion of the dam. This was sufficient to pass the stream flow during construction. After the work was entirely completed and closure was desired a 4 x 5-ft. gate valve which the contractor happened to have on hand was fitted to a frame around the opening on the upstream face and arranged to be operated by a 3-in. pipe, 150 ft. long, running to a hand wheel on top of the dam. The pipe was held in place by wooden guides fixed to the face of the dam by expansion joints. After the gate was closed, the opening through the dam was concreted from the downstream end. No attempt was made to salvage the gate valve used to effect closure.

Progress of the Electrical Home Campaign



The above is a view of the dining room of the electrical home opened in Oakland last month. The use which can be made of the two-way socket was shown on the tea table at the rear, which is equipped with toaster and chafing dish.



In the bed room of the Oakland electrical home, the hair drier was placed, ready for operation on the dressing table. The warming pad was in evidence and the most convenient and pleasing bed room illumination was demonstrated.

Nearly thirty thousand people visited the Oakland electrical home during the eighteen days it was open for inspection (August 26th—September 12th), and the Walter H. Leimert Company, real estate firm for the home, reported \$300,000 worth of property sold as a result of this publicity. The total attendance at all three of the electrical homes so far opened—San Francisco, Sacramento and Oakland—is between 56,000 and 60,000. Architects in these districts report their clients as constantly requesting more convenience outlets.

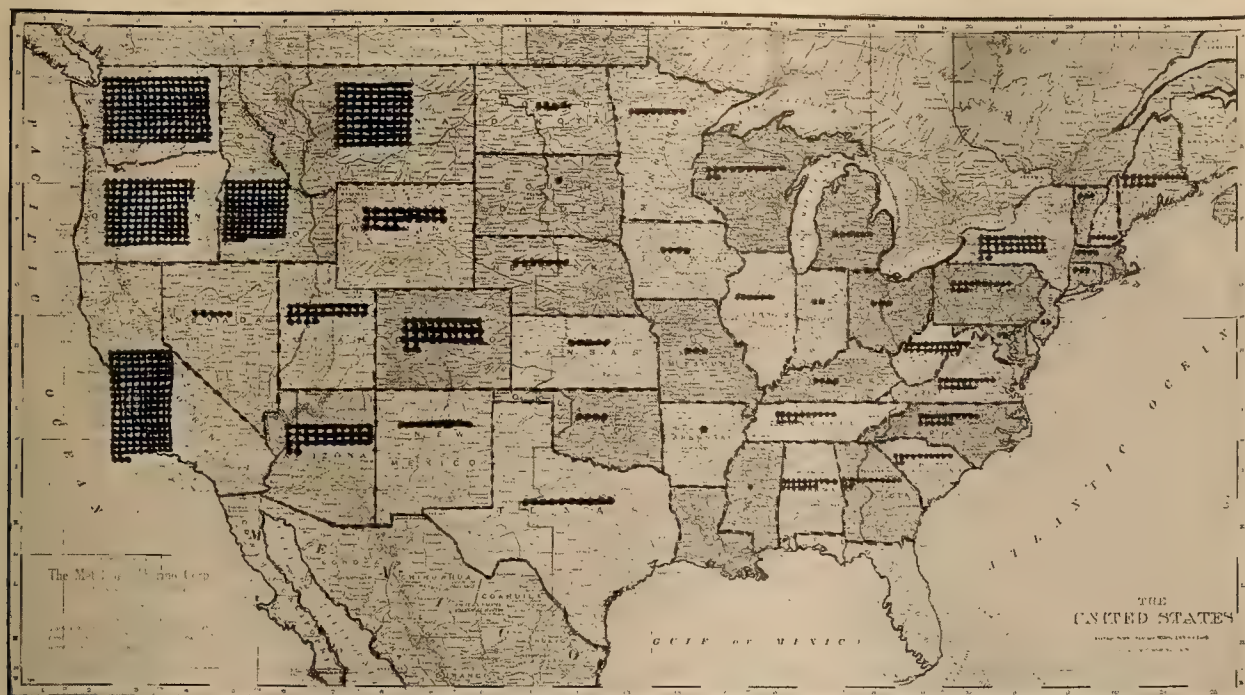


Fig. 4

tricity on the part of its citizens 6.75 times that prevailing elsewhere in the nation. For turning to chart No. 4 we see graphically represented the vast undeveloped water powers of the Nation in which it is seen that the eleven states from the Rocky Mountains to the Pacific Coast have within their boundaries some forty million horsepower, or seventy per cent of the vast undeveloped water powers of the nation, and yet to date the population in these states constitute but eight per cent of the national population. Recent accurate surveys of the power situation accomplished by the superimposing of power demand of all power companies west of the Rockies over the past ten-year period and projecting this demand into the future for nine years ahead indicates that with the present normal rate of growth of power development in the West, over seven hundred million dollars must be invested during the next nine years in order that the West may maintain its present wonderful strides in industrial and agricultural development.

In the vast financing of such sums of money, the self-interest appeal to the public is all-embracing and all-powerful. Chart No. 5 gives a graphic conception of this. The man within the industry, every citizen in the West, and indeed throughout the nation, is vitally interested, for these vast sums of money are to be directly distributed in channels in which he is interested. Take, for instance, the transformer man, who will receive seven and five-tenths per cent of the seven hundred million dollars; the man, also, who sells copper to the transformer man is interested; the man who sells fabric and the man who grows the material to go into the fabric is interested. Thus a delicate network of self-interest in this problem prevails throughout the nation. But to the man not directly interested in electrical matters a vital message of self-interest is also apparent, for it has been found in one instance, such as agricultural development, that for every

farm that grows up in the country where electrical pumping is so necessary, two houses spring up in the city. Let us then look to chart No. 5 and see where these sums of money go. To the laborer, to the lumber man, to the real estate man, to the banker, to the carpenter; indeed to every branch of commercial, industrial and civic enterprise, the message is a forceful one and has a definite dollar-and-cent value. Hence the one toast we drink to the future of the Pacific and Mountain states is, "More Power to the West."

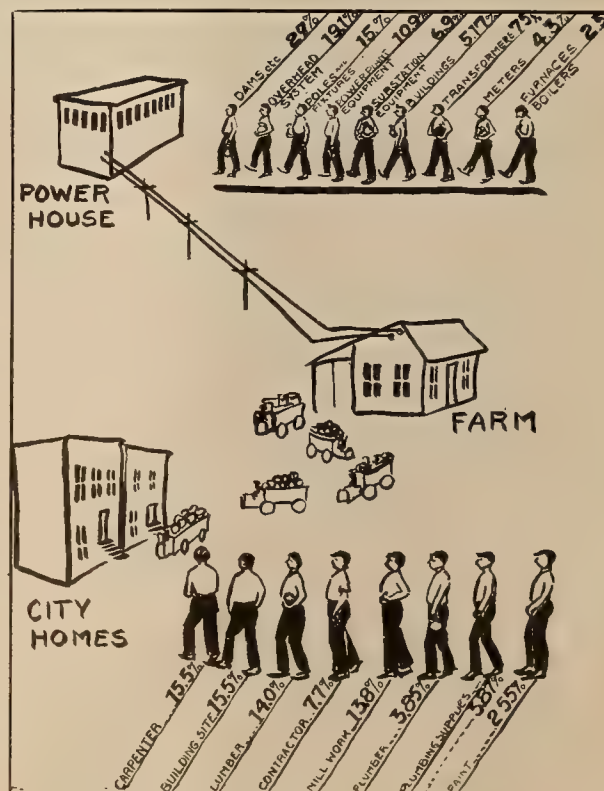


Fig. 5

Pamphlets and Clippings in a Business Library

BY VIRGINIA FAIRFAX

(The modern business house, whether it be office or industrial plant, accumulates great quantities of valuable material in the form of clippings, pamphlets and miscellaneous data. How to handle this type of material so that an item is instantly available when wanted is here taken up in the first of a series of articles by the librarian of the Carnation Milk Products Company, Chicago.—The Editor.)

THEIR VALUE WHEN ORGANIZED FOR READY REFERENCE

A New York bank, in one of its recent advertisements said: "Business judgment involving millions must be founded on facts. . . . Hasty judgment based on insufficient knowledge may cause widespread disaster."

The most successful business men of today are those who study the facts of their business, who study their trade papers and learn what other people are doing. It is the absence of accurate data, of complete knowledge, of planning supported by facts that causes disaster to enterprises that are launched without sufficient knowledge and not founded on facts. Any action is a gamble unless reinforced by exhaustive information and that information must consist, not only of precedent, but also of the experiences, experiments and discoveries of others in the specific field under consideration. A successful business man must gather these facts from original sources. The entire available field of information must be raked for facts applicable to the business needs of the individual business man or organization.

Where to Obtain Business Facts

How is the business man to obtain his facts? Where will he obtain the latest and most authentic information in order that he may have complete knowledge and avoid "hasty judgments"?

Years ago the business man depended on books for practically all of his facts. Scientific, industrial and financial problems were fewer than today. He had more time to read. He had more time to study and obtain the few facts that were needed for his business enterprises and these facts did not alter from hour to hour and become obsolete, as it were, over night.

However, in the present day of swift growth and rapid changes and when manufacturing and commercial organizations are conducting business in all parts of the world, the success of many enterprises hinges upon the character of the facts furnished for guidance and books alone, as sources of information, cannot be depended upon because many of them are out of date before they are printed. In fact, some of them are out of date before their authors have finished writing them. The value of books should not, however, be depreciated because undoubtedly many of them are most necessary in business, but the attention of the business man is emphatically directed to the value of a great Niagara of printed information that ought to be read because it contains the advance information from which books are made and in which will be found the accurate data and the last word on business facts.

If not through books, how is this flood of valu-

able information being spread? It comes in the form of pamphlets, brochures, reprints, reports, leaflets and letters. It is to be found in the scientific and technical journals, in the trade periodicals and in the newspapers. There are hundreds of technical associations, banks and commercial organizations, societies, clubs and private individuals printing and distributing information of great value on technical, economic, financial, industrial and sociological subjects that cannot be obtained elsewhere. Even in that class of printed matter which is designed primarily for advertising purposes, such as house organs and trade catalogs, will be found valuable experimental data, descriptions of tests and apparatus with diagrams and tables, that will not be found in books.

The many and varied departments of the Federal Government are printing and distributing valuable information. Also the departments of the various states and municipalities of our own and foreign countries are printing and distributing information on specific subjects, all of which may be had free of cost, or for a very nominal price. Most of this printed matter comes in pamphlet or mimeographed form. It records reliable facts and statistics, summarizes laws and furnishes up-to-date information that is needed day by day in business offices and for which the business man cannot wait until it gets into book form.

How to Make Pamphlet Material Valuable

Is this mass of printed material really of value? Most emphatically, yes, but not all of it to all business men. Bulletins, reprints, abstracts, periodicals and many newspapers specialize and that is what the busy man of today requires. It is not a very rare occurrence for a man to find in a single issue of a trade paper an idea that is worth many times all that he could pay for trade papers in a whole lifetime. By way of illustration: The librarian of an engineering firm noted in a trade paper an item of three or four lines that stated that the Geological Survey of a certain state had issued a pamphlet on the manufacture of water gas from bituminous coals. With the idea that it might possibly be helpful to one of the engineers who made a specialty of gas engineering problems, he wrote to the State Geological Survey asking for a copy of this pamphlet. When it arrived it was sent to the engineer's desk with a note calling his attention to it as something new that might contain some original ideas. After examining the pamphlet, he remarked that if certain ideas in it could be applied to a property on which he was working, and he saw no reason why they could not, it would mean a saving of many thousand dollars a year.

Every business man needs to have in his organization, as this business man had, a news gatherer who knows the interests and needs of that business organization, and who can classify the gathered news and make it available promptly, while it is news, or file the facts where they can be gotten quickly when needed.

The Value of Proper Filing

Government documents, miscellaneous pamphlets, clippings from newspapers, technical and trade periodicals, to be of use and of value must be properly classified and filed. It is a well known fact that many business men endeavor to keep miscellaneous pamphlets, reprints and clippings in their desk drawers, or stacked on book shelves, and when some special facts are needed, waste much valuable time hunting through this mass of dusty material for the information that they think they have stored away, or have a vague recollection that they saw somewhere, "not sure just where."

Business facts to be effective must be readily accessible and in such form as to be quickly comprehensible. This collection of informative data, these business facts, which so often clutter up a business man's desk, or through lack of appreciation of their value have been thrown away, could be effective and available on a moment's notice if correctly classified and properly filed.

The value of a file of reference material, or business facts, made from a careful selection of the pamphlets, reprints and leaflets that are sent to every business man, either unsolicited or by special request, and a judicious selection of clippings from newspapers and periodicals, cannot be over estimated. In private offices where such files have been established they have become one of the most essential and satisfactory tools of the business man. They give him the facts pertinent to his business interests in handy form, easy to consult, easy to carry about and study, in addition to the assurance that he has the last word on these subjects. The organization of files of this character requires careful planning, based on a knowledge of classification and indexing, a knowledge of sources for collecting facts pertaining to the task in hand and a wise discrimination in soliciting and discarding material. To be effective they cannot be managed in a haphazard way. Every one in the organization should cooperate. These files must be organized and maintained by some one who knows and who can give them the attention that is necessary to make them function properly.

What is the best method of filing this material, that is, what method is most economical of time and labor, making at the same time every little bit of information immediately available or useful, and also making possible the quick elimination of such material as may be supplanted by later knowledge or discovery?

Binding, boxes and scrapbooks have been used in past years with more or less success. Space does not permit of a discussion of the various advantages and disadvantages of these methods, especially since the vertical file is now generally recognized as the

ideal way of handling pamphlets, clippings and office records in general.

What is a vertical file? A vertical file is made up of folders and guides standing upright in a drawer, or set of drawers, and arranged in some predetermined order. The folders are marked by number, subject or name to indicate their contents, and in them is dropped the printed material pertaining to that subject or name, according to the method of classification chosen. The advantages of the vertical file are that they keep the contents clean, free from dust, accommodate all sizes and shapes of pamphlets and manuscripts, are easy to consult, provide for speedy re-filing and "a place for everything," and from it out-of-date material is easily and quickly discarded. Such files of pamphlets and clippings are designated by various people as, "Information," "Reference," "Data" and "Subject Files."

The best method of classifying this material and the details of the equipment necessary will be discussed in subsequent articles.

AN ELECTRICAL STORM



Tonopah, Nevada, was recently the scene of a storm which resulted in a six-foot flow of water down the streets. The above picture, taken by J. Otts, was the only successful one out of 50 attempts.

J. V. STRANGE, assistant general manager, Pacific Power & Light Company —

"It is the idealism which is back of the cooperative movement which gives it its practical strength."

—Northwest Electric Light and Power Association.

Advertising

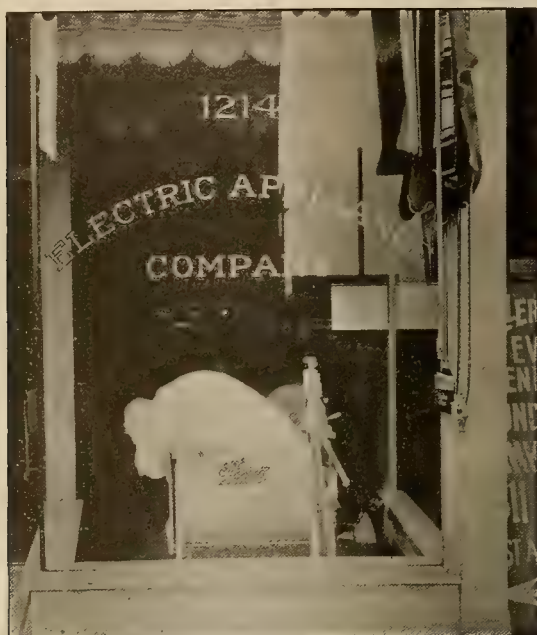
BY HOWARD ANGUS

(Making a salesman out of your window requires only taste and system, and is a form of advertising which will bring you a dollars-and-cents return as large as that from any other kind of publicity. The secretary of the California Electrical Cooperative Campaign here takes up the essentials of window display in the fifth of his series of articles on advertising.—The Editor.)

The show window has been called the silent salesman. If you doubt its pulling power, board up your store front and see what happens. Its value depends upon the location of the store, for in this as in all advertising, you want readers or lookers and their number depends upon how busy your street is.

The Value of the Show Window

The lowest value that any expert places upon the selling power of a window properly used is that



Motion in a window always attracts attention. On this mountain of foaming suds colored lights were played, while the machine was at work keeping the mass in constant motion.

it will increase your gross business 14% during the year, no matter where your store is located. Marshall Hale, of Hale Bros., in San Francisco, says that 14% is altogether too conservative. Most department stores charge their departments for one window display by the day or week. The value placed on these windows by the various department stores varies, but ranges generally from \$25.00 to \$100.00 a day for the department, depending on its location and size. A remarkable fact is that all departments of a department store not only are willing to pay the charge for the window, but are fighting for it. That emphasizes the important advertising value of a window. The four words—attention, interest, desire, action, are as important in a window's appeal to the buying motives as in other forms of advertising. The general weaknesses of contractor-dealers' windows are lack of unity, non-use of color, lack of display cards, and no seasonal tie-in.

Unity

Windows should tell one story at a time. If you attempt to display too many different kinds of appli-

ances at one time, you confuse the looker, emphasize nothing in particular and are in great danger of having windows resembling a junk shop. Ninety-nine out of every hundred persons are one-idea people. Don't put your entire stock in the window; leave some appliances in the store for your salesman to sell. If you have a large window, you can divide it into sections, and allow each section to tell its own separate and distinct story. Kindred appliances can be displayed together. For instance, a laundry or kitchen can be set up. That gives one central idea. By frequently changing your window it is possible during the year to exhibit to the people in the street every article you have in the store. Frequent changes are absolutely essential. The longest time one display should remain in a window is a week. A change twice a week is still better, three times a week better still. People then begin to expect to see something in your window.

Color

Color is an important and integral part of the art of window decorating, and appeals especially to women, who are more artistic than men. Colors in



An electrical window can be as beautiful as the window of an art store if careful attention is given to color and lighting effects. Feature one thing in the display and never overcrowd the window. Note the use of display cards here.

your window must harmonize. Color-clashes jar the senses, even of those who do not pretend to any knowledge of color harmony. This is because color harmony is based upon certain laws of nature that are inescapable, and the eye feels discomfort when those laws are violated. Reduced to its simplest terms, one law of harmony is this:

Red, yellow and blue are called "primary" colors because each is elementary and cannot be produced by mixing. But they can be combined to produce other colors. Thus, red and yellow make orange; red and blue make violet; blue and yellow make green. These colors can, in turn, be combined to make still other colors, but the basis of all is red, yellow and blue. Harmony is achieved when, in any given color scheme, the three primaries are represented. For example, suppose we have a drape of rich blue velvet. What other color note is needed to give harmony? According to our law, it is a combination of the other primaries, red and yellow, or orange. Orange is the color needed, and might be supplied by a bowl of flowers, marigolds or California poppies, or a piece of silk. In a similar way, violet (red and blue) harmonizes with yellow; green (yellow and blue) harmonizes with red. Black, white and gray may be introduced without upsetting the harmony of the color scheme.

There is much more to color harmony than can be set down here, but what has been given will be sufficient to show that perfect harmony is seldom a matter of accident. Its attainment is based upon the application of exact knowledge gained through careful study and observation. For this reason it would be well to secure the advice of an experienced window dresser whose business it is to know the laws of harmony and how to apply them.

There are colors that give the impression of heat, or of cold; in fact, colors that typify and assist every idea you wish to express. For instance, red, yellow and orange are "warm" colors, and suggest heat, and, therefore, can be used very well with heaters but not with fans. Blue, green and violet are "cold" colors; and suggest coolness, and can be used very well with fans but not with heaters. Neutral colors such as gray can be used very well to set off your nickel-plated wear, as they make the article stand out clearly defined without any reflections. Red, however, makes the nickel-ware reflect a copperish tinge and is very detrimental. I had occasion the other day to spend some time in studying color in the windows of the San Francisco merchants. Every merchant in any way appealing to women had color in his window, and the dressing showed that they had given it considerable study. It will pay you as electrical merchants to study these windows and their colorings and assimilate the ideas that the merchants are using.

Window Cards

Also when looking over these windows, notice how many cards with something descriptive about the goods are in these windows. From personal observation I am safe in saying that practically every store in San Francisco selling to women has little cards in its windows either describing the goods or giving the price. You, appealing to women buyers as you are, also should have cards in your windows. These cards should describe the service of the article especially and should be brief, containing as a general rule one direct statement, because it is only by means of this that the service idea can be put over

to the public. These cards should be made by a card designer. Unless they are artistic, they will give a cheap effect. Not to have a card in your window descriptive of the article or telling how economically it can be operated is like running in a newspaper an advertisement which consists of a picture and not a single word.

The display itself should also carry out the idea of the service of the article which can be best done by showing it in operation or in the place that it occupies in the home. An illustration of what I mean is a dining room table or a breakfast table entirely set with electric appliances in their proper place but conspicuously in the foreground.

Motion in the Window Display

A window with motion, of course, is better than a window without motion, because any moving object attracts attention and arouses interest, two of the fundamental principles of advertising and selling. But that motion must tie-in with the display and the story that the window is attempting to tell. An example would be a revolving table set for breakfast. This motion ties in very well because it brings the various appliances to the front of the window and shows them in order. A washing machine in operation is another good example. A fan blowing colored ribbons is another. Motion, however, that has nothing to do with the display does not help to tell the story and merely excites curiosity. It will attract people to your window but it will create no desire. An example of this would be jumping dolls or a monkey playing around in your window with your appliances set off to one side. Neither the dolls nor the monkey give any idea of the service rendered by electricity.

Seasonal Tie-In

Whatever appliances you are showing should tie-in with the season of the year. A close study of any other retail store of prominence will show you how careful its owners are in heeding the seasons. During the month of June, for instance, I passed many windows and read many advertisements in which the dealers were careful to mention or show the June bride. Did any of your windows tie-in with that idea during the month of June?

Illumination

Illumination is absolutely essential to a window. People at night are in a receptive mood. They are out to see, and are not worrying about business. Every night of the year hundreds of women go window shopping. They are merely strolling from store to store to see what they can see. Women walking to and from theaters and cafes always look at windows. Every window in the retail district should be lighted until 10 o'clock, or even later. For

R. M. BOYKIN, vice-president and general manager, North Coast Power Company —

"Every company is dependent to some extent on the experience of others and a policy of the fullest cooperation is the only basis upon which the work of any association can succeed."

—Northwest Electric Light and Power Association.

a merchant to neglect his appeal to the night crowd is unpardonable. During the day electric lights can be used to kill reflections. How many windows have you passed that were only a blur? Have they any value?

An electrical dealer's window should not only be illuminated but it should be the best illuminated window in the city. It should be an example that will give ideas to other merchants who are out looking over windows as well as to the general public. You are selling illumination. If you cannot light your own window properly, who wants your advice on lighting other windows?

Windows have a remarkable ability to sell small and moderately priced articles. The reason for this

is that the average woman has the money necessary to pay for the article in her pocket. She will make the purchase on the impulse of the moment, the action immediately following the desire. Drug stores such as the Owl and Sun illustrate this fact. If you have two windows you should have small appliances in one of them, or in both if they can be made to tie-in in any way with the central idea. This does not mean that large appliances should be kept out of the windows, because they should be in the windows very often in order to impress the public to the point of buying. Attention has been called to the ability of the window to sell small articles for fear that you may overlook this very important detail, and leave them out of the window entirely.

Mechanical Analogs

BY G. R. SCHUCK

(The use of the mechanical analogy for the illustration of the electrical process involves principles which are capable of being very extensively applied in the analysis of electrical phenomena. Following is another of the series of analogs compiled by a member of the electrical engineering staff of the University of Washington.—The Editor.)

EFFECT OF RESISTANCE AND CAPACITY IN PARALLEL, AND RESISTANCE AND INDUCTANCE IN PARALLEL

In Fig. 3 open valves control circuits C and R. There will be a flow of fluid in C, represented by the curve I_C and a flow of fluid in R represented by the curve I_R (Fig. 6). The flow of fluid in the main pipes F at any instant must be the sum of the ordinates of curve I_C and I_R at any instant. And the complete curve of flow for one cycle may be obtained by adding all of the ordinates of I_C and I_R and plotting another curve. The shape of the resultant curve I_{CR} will be the same general shape as the two curves from which it was constructed. The time relation which the fluid pressure curve E bears to the result-

ant curve I_{CR} will be somewhere between the point of coincidence and a quarter period, I_{CR} leading.

An exactly similar condition will be met when capacity and resistance are connected across the mains of an alternating current circuit. The current in the main conductors F and F_1 (Fig. 5) can be obtained by combining the current curves of C_1 and R_1 represented by I_C and I_R (Fig. 6), the resultant representing the main line current not only in amount, but in time relation or phase relation to the electromotive force curve. The angle of lead between the curve of fluid flow and fluid pressure will be somewhere between zero and ninety degrees, the exact angle depending upon the values of I_C and I_R .

A similar phenomenon will occur when the valves controlling R and L are opened and switches controlling R_1 and L_1 are closed, Figs. 3 and 5. The resultant flow I_{LR} is shown in Fig. 7 lagging behind the electromotive force at some angle less than ninety degrees and more than zero, depending upon the relative values of currents in R_1 and L_1 .

Effect of Resistance Capacity and Inductance in Parallel

Open all of the valves in the circuit in Fig. 3, allowing the three currents of fluid to flow through the various circuits. To obtain the rate of flow in the feeder pipes F it will be necessary to combine all of the three curves as was done with the two curves, and obtain as before the total rate of flow, I_{CLR} (Fig. 8), not only in amount, but in time relation or phase relation to the electromotive force. It should be emphasized here that the current curves of L and C are exactly opposite to each other, the maximum value of each occurring at the same time. Therefore the elastic membrane of the circuit will be at its extreme position toward the right, while the disc D will be in its extreme position to the left, their motions at all times being opposite in direction. If the rated flow in D is the same as the rate of flow in L the summation or resultant of these two curves will

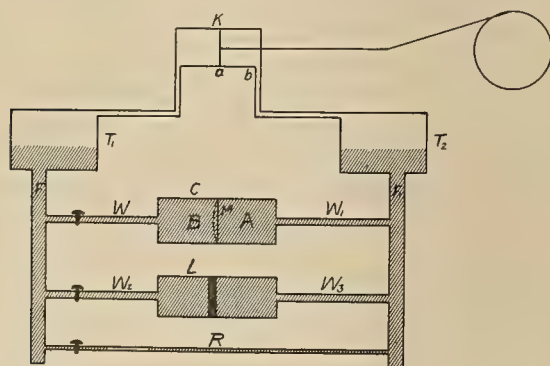


Fig. 3

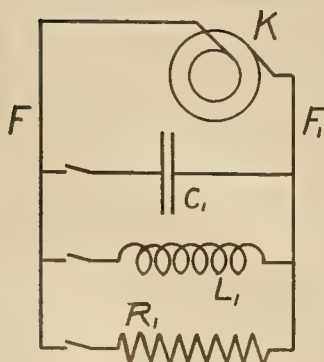


Fig. 5

Figure 3 above illustrates mechanically the principle of a cycle which is illustrated electrically in Figure 5 to the left. These figures are to be used in connection with the curves on the next page.

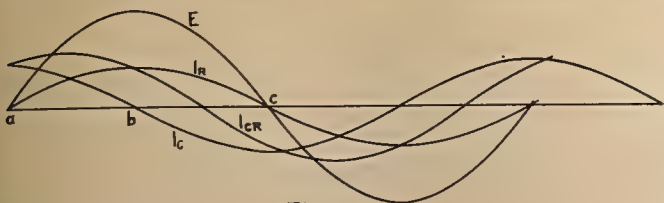


Fig. 6



Fig. 7

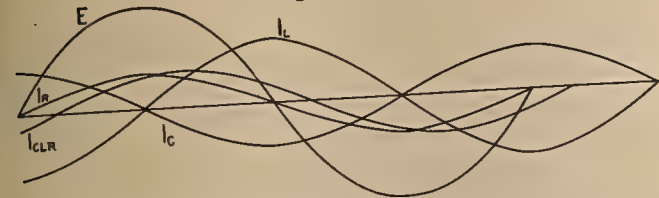


Fig. 8

Curves illustrating the relationships of resistance and capacity in mechanical and electrical circuits

be zero, and the only flow occurring in pipe F is that which supplies pipe R. But where does the flow of fluid come from which supplies the circuit C and L? An examination of the closed circuit C, L, and the connecting pipes will disclose the fact that the motion of the membrane M is timed exactly right with the disc D to cause a flow of fluid back and forth through this closed circuit, without being supplied by an actual flow from the main pipes F. In fact, if the valve in R were closed there would be no flow of current in the main F, the alternating pressure now doing nothing but regulating the frequency of oscillation in the closed circuit of L and C and possibly supplying a very small flow of fluid to account for frictional losses in pipes.

In Fig. 5, with all switches closed, exactly the same conditions will be met as in the analogous fluid system. If the proper amounts of capacity in C and inductance in L are used, the currents in each circuit will be equal and local oscillations of current will take place in L and C with no current being supplied from the mains, except that which supplies current to the resistance R and other ohmic resistances in the system; the electromotive force regulates the frequency of oscillation. This condition in electrical circuits is called "current resonance."

COMING CONVENTIONS

- Illuminating Engineering Society—Fourteenth Annual Convention — Cleveland, Ohio, Oct. 4-7
- National Association of Electrical Contractors and Dealers— New York City, Oct. 4-10
- British Columbia Association of Electrical Contractors and Dealers — Vancouver, B. C., Oct. 19
- Electrical Supply Jobbers' Association of the Pacific Coast — Quarterly Meeting — Del Monte, Cal., Oct. 21-24
- American Mining Congress—Twenty-third Annual Convention — Denver, Colo., November 15-20
- American Society of Mechanical Engineers—1920 Annual Meeting — New York City, December 7-11

Western Ideas

SPREADING INFORMATION is one of the principal functions of a business library, and one which is coming to be more and more appreciated. The library of the Southern California Edison Company uses, in the distribution of periodicals, the printed slip shown in the illustration. The magazine

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The terse, business-like manner in which library rules are presented on the front of the slip helps to keep these forgettable things before the borrower's mind.

LEWIS A. LEWIS, commercial agent, Washington Water Power Company —

"The best sign about the electric range business is that the companies which have most ranges on their lines are the ones best satisfied with them."

—Northwest Electric Light and Power Association.

Problem Course in Electricity

BY H. H. BLISS

(Do you know how to figure the power required for a mine hoist, the loss in a distribution line, the efficiency of a motor-driven pump? This article, the sixth of a series, carries on the discussion of power and efficiency started in the previous issue. The author is on the staff of the Riverside Junior College at Riverside, California.—The Editor.)

ENERGY LOSSES — MECHANICAL POWER

Lost Energy.—No mechanical machine operates without a loss of energy; the output is always less than the input by the amount of energy wasted in friction and turned into heat. Similarly every electrical device permits some of the energy to change

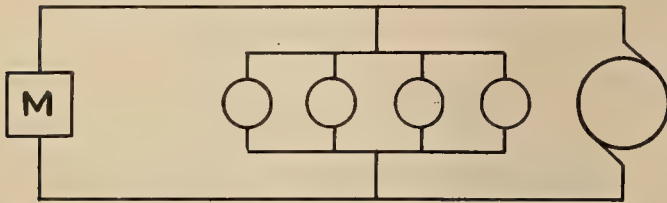


Fig. A.—Diagram of circuit containing generator lamps and motor, illustrating calculations in power and losses.

into heat, and (unless heating is the object of the device) this constitutes an electrical loss.

If it takes 3 volts to drive 12 amperes through a certain piece of wire, the power used $= 3 \times 12 = 36$ watts. Evidently the 3 volts = the voltage drop in that piece of line, and hence we get the rule: **"Watt loss in any conductor at 100% power factor = amperes \times volt drop in that conductor."** This leads to another rule: **"Watt loss in any conductor = amperes \times amperes \times ohms,"** since the volt drop = amperes \times ohms. It is found that this last rule holds true for all cases of alternating currents as well as direct currents, though the proof is beyond the scope of this paper.

A circuit is shown in Fig. A, containing generator, lamps and motor, with which calculations in power and losses may be illustrated. Assume that the motor absorbs an input of 1.5 kw. while taking a current of 14 amperes; the lamps take 200 watts each; the resistance of the loop between lamps and motor is .3 ohm and the loss in the line between generator and lamps = 117 watts. We want to find the voltage at the lamps and at the generator, the resistance of the line, and the efficiency of the transmission system. To begin, the motor voltage $= 1500/14 = 107$. The drop between lamps and motor $= 14 \times .3 = 4.2$ volts, so that the lamp voltage = 111.2. The four lamps take $800/111.2 = 7.2$ amperes, so that the current from the generator $= 14 + 7.2 = 21.2$ amperes. This number times itself ($21.2 \times 21.2 = 450$) times the line resistance = 117 watts; hence resistance $= 117/450 = .26$ ohms for the loop or .13 ohms per wire. The drop in the loop $= 21.2 \times .26 = 5.5$ volts. We might have got this from the loss and the current ($117/21.2 = 5.5$ volts) and then figured the line resistance. The generator voltage $= 111.2 + 5.5 = 116.7$. The output of the generator $= 116.7 \times 21.2 = 2470$ watts = input to the transmission system. The output =

$1500 + 800 = 2300$ watts. Efficiency $= 2300/2470 = 93\%$.

It is interesting to inquire what the voltage at the lamps will be when the motor stops. We can add the lamp resistance to that of the line, and find the current from the generator voltage (which we may assume remains constant at 116.7 volts). Then the lamp resistance times the current gives the lamp voltage.

Mechanical Power.—One horsepower (hp.) may be defined mechanically as the power required to lift one pound at the rate of 550 ft. per second, or to lift 550 lbs. at one ft. per second. Hence the number of hp. required for any operation = pounds pull \times feet per second $\div 550$. Then, if an automobile being driven at 42 ft. per second meets a total of 340 lbs.

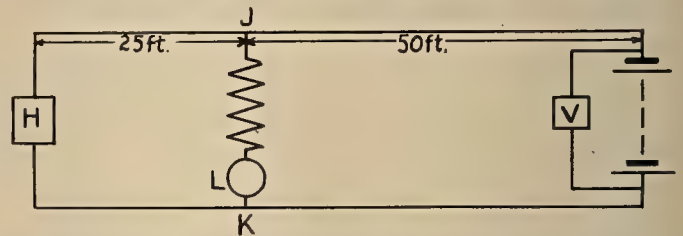


Fig. B.—Diagram of circuit containing battery and meter, as well as lamps, heater, and coil, illustrating calculation of resistances. See problem 69.

of road and air friction, etc., the engine must be delivering to the wheels a power of $340 \times 42/550 = 26$ hp. Some of the work done by the engine is always wasted in the transmission, differential, bearings, etc., so that the output of the engine may in this case be 30 hp. The efficiency of the apparatus between the engine and the tires may then be calculated as $26/30 = 87\%$.

A pump of 60% efficiency is found to lift 640 lbs. of water per second to a height of 79 ft. What is the input? Output $= 79 \times 640/550 = 92$ hp. Now, since efficiency = output \div input, input = output \div efficiency $= 92 \div .60 = 153$ hp. If the pump is driven by a water wheel of 70% efficiency, the input to that $= 153/.70 = 219$ hp. The efficiency of the combination of machines $= 92/219 = 42\%$. It is interesting to note that this equals the product of the separate efficiencies, $.60 \times .70$.

Mechanical Kilowatts.—It is perfectly feasible to measure mechanical power in kilowatts, just as electrical power may be expressed in horsepower. Since one kilowatt is $4/3$ of a hp., it requires the use of $4/3$ of 550, or 737 in place of 550 in the formula. Then a machine which hoists 230 lbs. 80 ft./sec. has an output of $230 \times 80/737 = 25$ kw. What is its efficiency if the input = 40 hp.? Is it $25/40$? No, for input and output must be in the same units. Changing the input to kw., we have $3/4$ of $40 = 30$,

and efficiency = $25/30 = 83\%$. If we changed the output to kw., $4/3$ of $25 = 33.3$ and efficiency = $33.3/40 = 83\%$. This is a point to remember.

In conclusion, **No. of hp. = No. lbs. of force \times No. ft. of distance \div (No. seconds \times 550)**, where it must be clearly understood that the force and the distance are measured along the same line. For instance, in calculating the power required to pull a 20,000 lb. car up a hill 300 ft. long in 14 seconds, one must multiply the length of the hill **not** by the weight of the car but rather by the pull upon the drawbar—possibly 1000 lbs.—before dividing by 550 times the number of seconds. The same idea applies to lifting water; the total weight of the water is to be multiplied by the **vertical** distance of the lift, which may be far less than the actual length of the pipe which carries the water, since the weight overcome is a **vertical** force.

Answers to Power Problems

46. .068; 2.27; 2 amperes.
47. 4 amperes; 440 watts; .44 kw.; $4/3$ of .44 = .59 hp.
48. Volts \times amperes \times power factor = 11,000,000; hence current = $11,000,000 \div (100,000 \times .80) = 137.5$ amperes.
49. $120/4 = 30$ volts.
50. Amperes = watts \div (volts \times power factor) = $19000 \div (440 \times .90) = 48$ amperes.
- 51.—Output = input \times efficiency = $19 \times .85 = 16.15$ kw. = 21.5 hp.
52. Output = $150 \times 92.7 = 13,900$ watts. Eff. of generator = $13.9/16.15 = 86\%$; eff. of M-G set = $13.9/19 = 73\%$.
53. Current = $110 \div (20 + 11 + .6) = 3.48$; volts across heater = 69.6; power = $69.6 \times 3.48 = 242$ watts.
54. $45,000 \div 2300 = 19.55$ amperes.
55. Input to set = $230 \times 6 \times .72 = 994$ watts; output = $994 \times .57 = 566$ watts; current = $566/60 = 9.44$ amperes.
56. Output of generator = 8.8 kw.; drop in line = 32 volts; input to motor = $40 \times 188 = 7520$ watts = 7.52 kw. Eff. of line = $7.52/8.8 = 85.4\%$.
57. Kva. = 12,000. Power factor = $9600/12000 = 80\%$.
58. Current = $1800/224 = 8.04$ amperes; resistance = $224/8.04 = 27.9$ ohms.
59. Combined resistance = 96.2 ohms. Circuit voltage = 110.6 volts. Watts = 61.2, 51 and 15.1 respectively.
60. Answers: 1210 ohms; 484 ohms; 202 ohms; 121 ohms.

New Problems

61. The voltage of a certain storage battery is 48; at its load the voltmeter reads 30. The resistance of the load is 15 ohms. Find the "loop resistance" and the ohms in each of the two wires of the loop. What is the watt loss in the line and what is the efficiency of transmission?
62. A 15-ampere arc lamp is fed through a rheostat of 2.6 ohms. Find voltage drop and watt loss in rheostat. Find power used in the arc itself, if the circuit voltage is 110.
63. The "equivalent resistance" of a 12-ohm heater in multiple with a certain coil measures 3 ohms. Find the ohms in the coil and the total power consumed by both devices on a 30-volt line.
64. Find the loss in the line in Fig. A when the motor is running and the lamps turned off, assuming that the motor draws 14 amperes.
65. The coils of wire known as the "armature winding" of a certain motor have a total resistance of .1 ohm. What is the watt loss in these coils when carrying 10 amperes? 20 amperes? 30 amperes? Another coil, known as the "field winding," has 16 ohms resistance. What is the loss here when 32 volts are applied?
66. If other losses in this motor (friction, hysteresis, etc.) total 150 watts, find input, output and efficiency when the field takes 2 amperes and the armature (in parallel with the field) takes 20 amperes at 32 volts.
67. In series with the 50-ohm transmitter of a telephone operator there is a 165-ohm "retardation coil" and two

parallel "induction coil" windings of 18 ohms each. Find the current which flows through the transmitter from the 26-volt storage battery, and the power consumed in one of the induction coil windings.

68. What is the voltage at the lamps in Fig. A when the motor is taken off the line? What is then the line loss? (Take resistances and generator voltage as figured in the example.)

69. The meter in Fig. B has a reading of 30 volts; the lamp has 4 ohms and the coil in series with it has 2 ohms; the heater has 1.1 ohms; the wire has 2 ohms per thousand feet. Find resistance of the whole circuit outside the battery.

70. Find the current and line loss in each wire of Fig. B. What would a voltmeter read connected across J K? What if across the heater?

71. What horsepower is required to move the gravel up the "bucket ladder" of a gold dredge with a pull of 20,000 lbs. and a speed of 1.5 feet per second?

72. It takes a pull of 500 lbs. to tow a crippled automobile at 15 miles per hour. Express the power in hp., kw., and watts.

73. Find number of gallons of water lifted 110 ft. in 5 minutes by a pump of which the output = 26 hp. (A gallon of water weighs 8.3 lbs.)

74. This pump is 65% efficient and it is driven by a motor of 88% efficiency. Find the electrical input to the motor in hp. and kw.

75. A certain mine hoist is driven by an electric motor of 90% efficiency; there is a loss of 14% of the power in gearing, friction of sheaves, etc. When the input to the motor is 30 kw., what is the hp. applied to moving the cages?

76. In this mine, loaded and unloaded cages move in opposite directions, and are so connected to the hoist as to act as counterweights. Find the speed of the cages in Problem 75 if the loaded cage weighs 3300 lbs. and the unloaded one 1600 lbs.

77. A small electric locomotive exerts a drawbar pull of 1200 lbs. when moving a trainload of rock at 5 miles per hour. This over-all efficiency of the locomotive being 65%, what current does it draw from its 84-volt storage battery?

WIRED WIRELESS

Successful telephone communication has been held over live high tension lines by the American Gas & Electric Co., which has been convinced thereby that the method employed will solve one of its most important problems, namely, insuring a reliable and less expensive mode of communication between its load dispatchers and interconnected stations.

The test which proved the practicability of the method, was conducted during July between two of the company's stations, over a live 11,000-volt, 60-cycle transmission line, 12 miles long. Between the transmitting and receiving sets were the windings of the power transformers at both ends of the line and an underground cable, making the equivalent length of transmission about 21 miles.

The system employed works on the principle of the wired or directed wireless, and involves the use of apparatus to tune out the power-circuit frequency. The carrier current for the conversations had a frequency in excess of 5,000 cycles. The transmitting and receiving sets were connected with the 2,300-volt buses at each station, but they could have been attached to the 440-220-volt circuits with just as satisfactory results, according to engineers who have developed the system.

R. C. KENNEY, NePage McKenny, Portland —

"The success of the cooperative movement is dependent upon the concrete expression of it by every individual concerned."

—Northwest Electric Light and Power Association.

SPARKS—Current Facts, Figures and Fancy

(The largest pier in the world, the fastest American destroyer, the biggest bank clearings in the Northwest, the best paved city in the world—all these comfortable superlatives are introduced on this page, and anyone who is feeling downhearted is recommended to read them. Those who are not, can find out how to listen in on their neighbors' irrigation.—The Editor.)

Since the signing of the water-power bill in June applications have been pouring fast and furiously into headquarters at Washington. These now total applications for 500,000 hp.

* * *

Even if you can't talk to the motorman, it's nice to know his name. At least the city of Los Angeles thinks it worth while to equip its new one-man safety cars with a name-plate which introduces the operator to the riders.

* * *

One realizes that it is still a gloriously untamed America when statistics show that six-sevenths of our land is still uncultivated. It seems there is opportunity for all of the power we can develop, hydroelectric and otherwise.

* * *

A recent report shows San Francisco leading the world in street pavement work. She has 4,600,000 square yards of modern pavement and a public street paving program calling for an annual expenditure of \$1,000,000. Of the paved area, 4,120,000 square yards are asphalt, 340,000 square yards stone blocks, and 125,000 square yards are brick.

* * *

A week's work for a family of four amounts to about eighty hours, or eleven hours a day, that is, when the house is not of the blessed 'home electrical' type. The same household, properly machined, requires only about sixty hours of work in a week, or a little over eight hours a day. Can the busy housewife make use of three hours daily leisure?

* * *

We might say that all that is gold does not glitter when considering a recent estimate that if the "hogged" fuel or saw mill refuse now being wasted in the Northwest part of the United States were put to use in the generation of electric power an addition of 3 billion kilowatt-hours would be made to our Western load. You never can tell where the riches lie.

* * *

The latest and speediest of our American destroyers, the "Satterlee," can make 38.257 knots because she is equipped with 14,000-hp. turbines which make possible the development of 31,223 horsepower. Each of these turbines drives a propeller through a floating frame gear that reduces the rated turbine speed of 3050 r.p.m. to 452 r.p.m. for the propeller.

* * *

— Reports from France show that in truth, necessity is the mother of hydroelectric development. The scarcity of coal during the war has so hastened the development of this country's water power that it will be doubled in the six years, 1916-1921. Con-

struction planned for 1920 and 1921 will bring the total development by the end of 1921 to 1,600,000 hp., or about 20% of the available power.

* * *

Those who like to see the figures down in black and white will be interested in the fact that Portland is rejoicing over an increase in bank clearings greater than she had expected even with the Shriner Convention as a booster. September statements up to the middle of the month put her ahead of all her progressive Northwest sisters, showing the clearings for those two weeks to be \$99,249,536.

* * *

All parts of the old world are finding that the coal shortage is making the development of hydroelectric power a necessity. Two Italian companies, now capable of producing 20,000 hp. and 8,000 hp., find this output so inadequate that they intend to increase their plant to a capacity of approximately 280,000 hp. with a possible output of 700,000,000 kw-hr. a year. This would mean a saving of nearly 1,000,000 tons of coal.

* * *

Possibly the troubles of the irrigation district meter man are about at an end. Why? Because there has come a device which will allow him to do his work over the telephone. An electrical connection is made to what is known as the water watch or water meter so that a click is distinctly heard over a telephone. Thus by listening and counting the number of clicks to the minute it is easy to ascertain the rate of flow through the meter.

* * *

The electrical idea has been sold to the cooks of America. Seventy-five thousand electric ranges are in use at this time in the United States as against eight or ten thousand in 1915. And more than this, a certain manufacturer has made the statement that he is planning to turn out no less than sixty thousand ranges in the year 1921. Spokane comes forth to state that she can claim more of these electric ranges than any other city in the world.

* * *

Seattle announces that she is ready to take care of all her outlying districts can produce even through the most thorough application of electric power. Thirteen million cubic feet of warehouse space along the water front is generally considered ample housing provision for all producers that may choose their way through this port and then in case dock accommodations may not be what they should be, she has decided to build the largest pier in the world. It is to be 2,566 feet long and 360 feet wide and will be large enough to dock eleven ocean-going vessels at one time.

PERSONALS

Markham Cheever, general superintendent and chief engineer of the Utah Power & Light Company, Salt Lake City, Utah, has recently been appointed chairman of the Hydraulic Power Committee of the Technical Section of the N. E. L. A. This important appointment means much to the West. Mr. Cheever has been continuously connected with the construction and operation of hydroelectric properties for the past seventeen years at Niagara Falls and in Colorado, Idaho and Utah. The appointments on Mr. Cheever's committee from the

various Western geographical divisions of the national association are as follows:

PACIFIC COAST DIVISION

H. A. Barre, executive engineer, Southern California Edison Co.
J. P. Jollyman, engineer electrical construction, Pacific Gas & Electric Co.
C. O. Poole, chief engineer, California-Nevada Power Co.

NORTHWEST DIVISION

John B. Fiskien, consulting engineer, Washington Water Power Co.
B. M. Merrill, superintendent light and power, Washington Water Pwr. Co.
H. H. Schoolfield, chief engineer, Pacific Power & Light Co.
G. C. Sears, superintendent, Puget Sound Power & Light Co.
W. H. Trenner, chief engineer, Idaho Power Co.

ROCKY MOUNTAIN DIVISION

Norman Read, vice-president and general manager, Colorado Power Co.
J. A. Clay, general manager, Western Colorado Power Co.
J. F. Dostal, general manager, Colorado Springs Light, Heat & Power Co.

E. B. Skeels, formerly a civil engineer of Missoula, Montana, is now superintendent of the Bates and Rogers Construction Company with headquarters in San Francisco.

R. E. Fisher, commercial manager, Pacific Gas & Electric Company, has been appointed to represent the Pacific Coast Division of the N. E. L. A. on its Commercial Section.

George F. Wakeman, Pacific Coast representative of the Edison Storage Battery Company, with headquarters in San Francisco, has been called East to the parent company for consultation where he will remain for some weeks.

R. L. Emrick has been appointed superintendent of circulation, Pacific Coast Division, McGraw-Hill Company, Inc. Mr. Emrick succeeds Mr. A. T. Tregoning who has left the employ of this company to become circulation manager for the Coast Banker.

V. S. McKenney of the NePage-McKenney Company, Seattle, recently left that city for Kansas City, Mo., where he will supervise the installation of electric wiring, lighting, and so forth, in the new Pantages Theater under construction in that city. The NePage-McKenney Company was recently awarded the contract for this work.

A. E. Chandler, San Francisco attorney and engineer, has been spending the past two weeks as arbitrator for the Federal Court at Bishop, Inyo county, in a controversy between the Bishop Creek Water Users' Association and the Southern Sierras Power Company. Mr. Chandler is author of the well known book, "Western Water Law."

George Bush, formerly telephone specialist for the Western Electric Company in Seattle, recently resigned his position with that organization to accept a captaincy in the Signal Corps, U. S. Army. His place will be filled by John R. King, who formerly held an executive sales position with the Vulcan Iron Works of Seattle. Mr. King, some years ago, was affiliated with the Puget Sound Traction, Light & Power Company in the sales division.

Major U. S. Grant 3d, grandson of President U. S. Grant, and son of U. S. Grant, 2nd, is now head of District No. 2 in the War Department Service of Rivers and Harbors, his activities largely being those of upper San Francisco Bay, the Sacramento and San Joaquin rivers. Major Grant takes the place of Col. Kelly, who recently resigned to accept a position on the Water Power Development Board, brought into existence by the recent water power legislation.

H. A. Lemmon, formerly sales manager for the Truckee River General Electric Company of Reno, Nevada, is now head of the personnel department of Stone & Webster Company, with headquarters in Boston, Mass. Mr. Lemmon is doing splendid work in his new activities and it will be recalled that his knowledge of the subject of psychology and general personnel of salesmanship was of the highest order while engaged in activities on the Pacific Coast.

Barnet Lyon, member of the board of railway control of Holland and president of an investigating commission of electrical engineers, together with his associates, recently spent some time in Montana and Washington investigating the electrification of the Chicago, Milwaukee & St. Paul Railway. The others of the party were **V. L. Marinnet**, chief of electrical traction, Netherlands, and secretary of the commission; **V. Vanlessen**, chief of electric service, Rotterdam and Schveninge Line; **H. Doyer**, consulting electrical engineer, and **M. Burgerdyke**, who is general manager of several interurban systems. These gentlemen spent some time over the Montana end of the system and more recently in Seattle, with a view to utilizing some of the principles in the electrification of state railways which is contemplated in the Netherlands. They left the West about the middle of September to return to Holland.

L. T. Merwin, who has recently been promoted from general superintendent to assistant general manager of the Northwestern Electric Company at Portland, Oregon, was graduated from the University of California in 1896. He began his electrical career with the San Joaquin Light & Power Corporation in 1901, as station operator, becoming chief operator at the Fresno plant and later assistant to the city superintendent. In 1906 he became superintendent of the Nevada-California Power Company, at Goldfield, Nevada, and in the following year electrical engineer for the Nevada Consolidated Mines Company. Early in 1912 he overhauled the electrical equipment in the Trinity Gold Mine in the northern part of California. In May Mr. Merwin came to Portland to assist in the design and later take charge of the construction of the Northwestern Electric Company's transmission line on the north side of the Columbia River Gorge. When the plants of the Northwestern Electric Company were completed he took charge of them as superintendent of operation. Since 1916 he has been general superintendent, in charge of all of the physical equipment of the company, which includes not merely a distribution system of light and power, but comprises an extensive steam heating system as well. It was in July of the present year that he became assistant general manager.



R. W. CLARK, Puget Sound Power & Light Company —

"Aside from the practical results of cooperation, the value of knowing each other and each other's problems is enough to make the cooperative league worth trying."

—Northwest Electric Light and Power Association.

Captain Howard M. Angus, secretary of the California Electrical Cooperative Campaign, has resigned his position to enter the United States Army as a Captain of Infantry. Captain Angus graduated from Occidental College with the class of 1913 with the degree of A.B. and from the University of Southern California in 1916 with a degree of J.D. After graduating from college he was employed as sporting editor of the Los Angeles Times and when the war broke out in 1917 attended the first Reserve Officers' Training Camp



at the Presidio of California, graduating with the rank of Second Lieutenant. Captain Angus was assigned to the 362d Infantry and in the Meuse-Argonne offensive he was promoted to the grade of Captain for gallantry on the field of action. Upon his discharge from the army Captain Angus accepted the position of secretary of the California Electrical Cooperative Campaign on August 1, 1919, which position he relinquished on Sept. 28 to report to the Commanding Officer at the Presidio. A great part of the success of the Campaign is directly due to the untiring efforts and ingenuity of Captain Angus, who leaves the industry with the best wishes of all connected with it.

Alexander Wyllie, city electrical engineer of Auckland, New Zealand, is a recent San Francisco visitor.

Herbert C. Moss, of the Standard Electric Company, Seattle, recently enjoyed a short trip to Mt. Rainier.

J. B. Fullerton, district manager of the Apex Vacuum Cleaner Company, visited in San Francisco for several days this past week.

W. A. Rowald, superintendent of the Emeryville factory of the Western Electric Company, has left for a visit to the Hawthorne factory of this company.

A. B. West, vice-president of the Southern Sierras Power Company, Riverside, California, and **E. B. Criddle**, also with that company, are recent San Francisco visitors.

E. J. Wallis, Pacific Coast district manager of the Western Electric Company, has left for the East on an extended trip that will include the annual conference of company executives.

S. H. Taylor, president of the Electric Railway and Manufacturers' Supply Company, has left for a combined business and pleasure trip through the East. Mr. Taylor will be accompanied by his wife.

V. E. McCain, formerly engaged in sales work in the Tacoma offices of the Western Electric Company, has been transferred to the Seattle branch as house goods specialist. Mr. McCain made quite a reputation for himself in the Tacoma division and comes to the Seattle offices highly recommended.

W. L. Huber, consulting engineer with the Southern Sierras Power Company, and **T. H. Means** of Cope-Rand-Means Company, San Francisco, have been in Bishop representing the Southern Sierras Power Company in a controversy which is taking place there between that company and the Bishop Creek Water Users' Association.

C. E. Blee, assistant professor of civil engineering at Stanford University, has resigned his position on the staff of the University to return to the California-Oregon Power Company as assistant engineer to **P. O. Crawford**, who is chief engineer of the company.

L. J. Corbett, formerly professor of electrical engineering at the University of Idaho, who has during the past six

months period been engaged as an associate professor of electrical engineering at the University of California, is now with the valuation department of the Pacific Gas & Electric Company, with headquarters in San Francisco.

A. H. Griswold, formerly plant engineer for the Pacific Telephone & Telegraph Company, with headquarters in San Francisco, and later Colonel of Engineers in charge of communication behind the trenches for the Allies on the battlefields of France, has now become assistant chief engineer of the International Western Electric Company with headquarters in New York City.

H. J. Gille, district sales manager, Puget Sound Power & Light Company, Seattle, **R. W. Lindley**, assistant sales manager, Bellingham division, and **L. R. Grant**, manager of the appliance department in the Seattle offices, will leave for Boston about Oct. 5, to attend a sales managers' conference to be held by the Stone & Webster interests in Boston. They expect to be away from the Puget Sound district about three weeks.

George J. Walton, formerly manager of Klamath Division of the California-Oregon Power Company, recently resigned to become cashier and a director of the First National Bank of Merrill, Klamath county, Oregon. **J. C. Thompson**, formerly secretary of the company, succeeded Mr. Walton in the company organization. His appointment became effective Aug. 1, and he is now "Division Manager Thompson," Klamath Division, with headquarters at Klamath Falls, Ore. **Byron H. Hurd**, formerly assistant secretary, is now secretary of the company.



W. W. Hanscom, consulting engineer, has recently been elected chairman of the San Francisco section of the American Society of Mechanical Engineers. Mr. Hanscom in 1886 went to work for the Union Iron Works, developing the electrical department of that company. He held the title of chief electrical engineer and in 1905 left the employ of the Iron Works to become manager of the Central Electric Construction Co. In 1908 he went into business for himself as a consulting electrical and mechanical engineer. The selection of Mr. Hanscom as chairman of the San Francisco section of the A. S. M. E. points toward an extremely prosperous season for that section with a broadening of its field of activity and usefulness.



Jay G. De Remer, consulting engineer, has been elected secretary of the San Francisco section of the A. S. M. E. for the next year. Mr. De Remer graduated from the University of California with the class of 1907 and for the next three years served with the Westinghouse Company as an electrical engineer. Mr. De Remer then served with the United Light and Power Company, San Francisco, and later went to New York. During the war he served as technical expert on anti-submarine devices for the navy and for the past year has devoted himself to consulting engineering. Many interesting trips are being planned for the section under the direction of Mr. De Remer which will augment the papers to be presented.

Meeting Notices for Electrical Men

(Information to the public concerning the activities and ideals of the power companies was the keynote of two important recent meetings—those of the Public Relations Committee, Pacific Coast Section, N. E. L. A., and the San Francisco Electrical Development League. Among other notable gatherings is the joint convention in Colorado where questions of vital interest to the industry were discussed.—The Editor.)

Public Relations Committee of Coast N. E. L. A.

Discusses Work in Hand

When the Public Relations Committee of the Pacific Coast Section of the N. E. L. A. convened in San Francisco on the afternoon of Sept. 8, the meeting took the form of a general discussion as to how the committee could function to the best interests of the utilities. The proposed work for the Public Relations Committee of the N. E. L. A. was outlined by R. H. Ballard, chairman of the local Section, who suggested a division of the committee into three sub-committees as follows:

1. Committee on Public Information. The establishment of contact between the press, the public and the power companies. S. M. Kennedy was appointed chairman.

2. Company Relations with Employes. W. E. Creed was appointed chairman.

3. Relations of Regulatory Bodies vs. Public Utilities. This was discussed but the subject left open.

Results of public policy were shown through two editorials from newspapers of Los Angeles and Fresno, outlining the necessity of public utility development.

A general discussion as to newspaper contact brought out that paid advertising had its place and value and was necessary, but that news items relative to the development of the electrical industry and the necessity for that development as affecting the public should constantly be kept in the newspapers and before the public; that the best contact with the local paper was through the local district manager, who should be kept closely in touch with company news and who should be quoted in the items; that such news should be approved and edited and always kept strictly to facts.

Certain members took up the question of rebate on policy, and while it was generally agreed that fairness in satisfying the customer was paramount, some felt that such leeway in the settlement of accounts might be injurious. The financial statements being made by bond houses, where only part of the truth was told, were criticized as being unessential in the selling of securities.

On the question of company relations with employes, the consensus of opinion seemed to be that double checking by different department heads and probably by inspectors or personnel men could keep the managers in touch with the ideas of the employes so that the employes would be encouraged to enter more actively into all discussions. Power companies were asked to suggest anything along the line of rewards for efficiency in getting the best from an employe.

Contractors and Dealers to Meet in Baltimore

A score or more questions of vital importance to the electrical contractors and dealers of this country will be discussed at the twentieth Annual Meeting of the National Association of Electrical Contractors and Dealers to be held in Baltimore, Md., October 4th to 9th.

San Francisco Electrical Development League's Publicity Meeting

That the backing of all public-spirited citizens in the West is vitally necessary before the hydroelectric program now in view can render the requisite service to the industrial and agricultural development of that portion of the country

was ably presented by Robert Sibley, editor of the Journal of Electricity, and Charles K. Field, editor of the Sunset Magazine, at the first fall meeting of the San Francisco Electrical Development League on Sept. 13.

It was journalists' day, and that profession was ably represented by the presidents or editors of eight daily publications of San Francisco and the Bay region. In addition all branches of the electrical industry were in good attendance, the total meeting numbering about 350.

With the use of charts, Mr. Sibley indicated that the Pacific Coast led all other sections of the United States in water-power resources, in lowest cost of energy to consumers, in highest per capita consumption and highest per capita revenue to the power companies, and brought home the need for continued co-operation in order to interest all parties in the region with this one big idea of develop-

ment. From the projected expenditure of three-quarters of a billion of dollars in hydroelectric construction over the next nine years, he showed how all people in the areas affected would benefit by the development, and indicated the necessity of making the movement popular in order to attract the local finances.

Mr. Field showed a hopeful journalistic attitude toward cooperation, saying that

"as far as the industry is linked with the logical opportunity of the community and with its needs, immediate and potential, the press should keep pace with the industry. It would seem to our interests as journalists directly to do so, if we consider ourselves upbuilders of a community, rather than mere reflectors of its life or merely a part of its varied entertainment.

F. D. NIMS, vice-president and chief engineer, Washington Coast Utilities—

"With 48 per cent of the developed hydroelectric energy in this region the West should feel the responsibility of leading in research along these lines."

—Northwest Electric Light and Power Association.

BUILDERS OF THE WEST — LXXXVI



D. L. HUNTINGTON

The sums of money required in coming months for the financing of hydroelectric enterprise are so vast that the greatest care must be taken in the visualization of the future and the maintenance of reserves in order that the utmost stability of these investments may be secured. To Daniel L. Huntington, president of the Washington Water Power Company, this issue of the Journal of Electricity is affectionately dedicated in appreciation of his contribution to the West in establishing for his utility organization, in the face of adverse industrial and economic situations prevailing in his territory for some years past, reserves that make for record attainment in Western endeavor of this kind.



The mighty press demonstrated its desire to forward the electrical industry in the West at the Publicity Meeting of the San Francisco Electrical Development League, Sept. 13, 1920.

"If we grant that the development of a Western community is more or less proportional to and dependent upon its electrical development—and I think we may safely grant that—then it would seem that we have a distinct part to play and are not to leave it to the initiative and promotion of the industry concerned."

He brought out the vital fact of the never-ending cycle of reproduction in the water-power resources of the mountains as against the non-reproduction of the mineral resources used in power development.

Mr. Field struck one note of humorous interest when he asked "why there were a thousand and one different kinds of plugs for the thousand and one household appliances." But he partly answered it in suggesting that it provided the tired business man with a puzzle in finding a way to connect his percolator. He hoped for a standardization of attachment plugs.

Before the addresses a resolution was passed assuring David P. Barrows, president of the University of California, the closet cooperation of the League in securing from the state legislature such support and funds as may be necessary to bring the need for increased electrical engineering facilities into a concrete reality.

Previous to this, clear reports were presented by the Statistical Committee, showing statistics of the electrical industry in the city and county of San Francisco, and by the Public Policy Committee as to its recommendations.

San Francisco Downtown Association Hears Hydroelectric Talk

Bringing home to the business man the service of the central station, John A. Britton, vice-president and general manager of the Pacific Gas & Electric Company, spoke before the Downtown Association of San Francisco on Sept. 15. He briefly traced back to its inception the use of electricity for lighting, and touching on its development and that of the central stations in the West, brought the idea right on down to the present day, with references to the records in construction which have been established in the Western states.

While he stated that in the past capital couldn't be enticed into the several districts to develop the huge water-power resources of the West because of the short-sighted policy of the government in not releasing water powers, he believed these resources had been unlocked through the passage of the water power bill and that the necessary finances would be forthcoming. In this respect, he gave fifty millions of dollars as the amount of new capital needed each year to carry on the electrical development of the West.

San Francisco Electrical Retailers Elect Officers

The Electrical Retail Dealers' Association of San Francisco met on Sept. 29 to hear Harry Saxe, vice-president of Bunster-Saxe Company, on the Installment Plan Systems, covering methods of determining credits, handling accounts, and the effect of the installment plan on profits.

Officers of the organization as elected at the last meeting are M. L. Scobey, president; Percy Schwartz, vice-president; M. P. Meyer, Louis Levy and W. S. Hanbridge, executive committee. J. L. Richards is chairman of the membership committee and W. D. Kohlwey, chairman of the public policy committee.

Colorado Convention Features Utility Finance and Regulation

The seventeenth annual convention of the Colorado Electric Light, Power and Railway Association and the first convention of the Rocky Mountain Division, N. E. L. A., were held jointly at Glenwood Springs, Colo., on Sept. 13, 14 and 15.

Utility securities were discussed by A. C. Foster, president of the Bankers' Trust Company, Denver, who spoke in an optimistic tone on their future. Norman Read, Colorado Power Company, and president of the Association, took up the lack of understanding of the problems of the utilities by the public. He said that marketing of these securities would be easier and the public would be led to a better appreciation of the service by an educational campaign to foster a spirit of respect for the utilities and commissions. Mr. Dwight, engineer of the Public Utilities Commission of Colorado, spoke strongly for a better understanding between the utilities and the commissions, and brought out that although the commissions now have a better knowledge of the public utilities, cooperation is needed to combat for the common good the forces which are working to bring regulation to naught.

The necessity of uniformity in power contracts throughout the state was emphasized by T. O. Kennedy, Denver Gas & Electric Light Company, who indicated the wide divergence of practice in charging for extensions and in apportioning the costs among the various users of the line.

The newer and broader activities at the headquarters of the Association were clearly defined by Martin Insull, president of the N. E. L. A.

Regulation from a public policy viewpoint and the obligations under which the utilities labor were discussed by W. H. Onken, Jr., editor of *Electrical World*. He touched particularly on a higher phase of municipal ownership

through customer ownership of securities and told why preferred stocks and bonds were being taken rather than common stock.

C. A. Semrad, Boulder, general manager of the Western Light & Power Company, was elected president; T. O. Kennedy, Denver, general superintendent Denver Gas & Electric Light Company, was elected first vice-president, and F. Norcross, Greeley, was elected second vice-president.

Convention of Illumination Engineers

The question of electric lighting in all its phases will be discussed at the fourteenth Annual Convention of the Illuminating Engineering Society which will be held in Cleveland, Ohio, October 4th to 7th. J. E. North, of the Cleveland Electric Illuminating Company, is chairman of the general convention committee.

Monograph on Illumination Before San Francisco Bay Cities Chapter I. E. S.

A first presentation of Dr. George A. Hoadley's paper "Monograph on Illumination" was given before the San Francisco Bay Cities Chapter of the Illuminating Engineering Society on Sept. 24 by Russell Hoadley. The paper is an interesting and authoritative history of lighting from the earliest period to the present day, and was illustrated by slides.

Mr. Hoadley traced the development from the time when the open fire was the only means of illumination through the use of the pine torch, fat lamp, the candle, whale oil, found late in the seventeenth century, down to mineral oil which is still widely used. With the use of gas and electricity came the necessity for some form of central station and distributing system.

The greater the application of illumination the more necessary it is to study such phases as measurement, distribution, glare, effects upon color of objects, design of fixtures and so forth, each of which was covered in the monograph. Although illumination is one of the youngest of the sciences, it was brought out, great results have already been accomplished, but there is still much to be done to perfect a system which it can be produced cheaply, easily and of such a quality that it will be restful and not harmful to the eye.

McGraw-Hill Service and Federated American Engineering Societies

James H. McGraw, president of the McGraw-Hill Company, Inc., has expressed himself in favor of the Federated American Engineering Societies in the following letter which was sent to each of his editors. It shows such a wholesome endorsement of the principles governing the new federation that it is presented here that all engineers may benefit by his opinion. The Journal of Electricity is heart and soul for the accomplishment of this new ideal, for the Journal of Electricity sees in this movement the salvation of the engineer, comment upon which may be found on the editorial pages of this issue:

"I think we should organize the editors for definite action. The editors must work this out themselves, each for his own paper, to be sure, in his own language, but the McGraw-Hill editorial policy is to put it over—to get it done—to line up the engineers of the country or to rally them to the big idea. If it flounders for lack of definite leadership very long, it will all go in the discard, as it should. We must not let our publications flounder or fall down in this matter for lack of coordination. In other words, we should organize and develop a definite program of action, and be all ready for this next official meeting. The engineer has a much bigger place in the world's affairs than he, himself, realizes, bigger than the public realizes. Engineers as a class have never acted together, hence have never reaped the harvest of team work. If the McGraw-Hill engineering papers can compel attention to the NEED and PICTURE the results in the way of accomplishment for the engineer and the public, we will be rendering a great public service. We are given a great opportunity to serve,—to serve the engineer and the public, and at the same time our own interests. If the Federated Societies eventually fails, if we do our work right, we have made a bigger place for the engineer, and we have earned his everlasting gratitude. Here is the kind of an opportunity for which we have been looking."

NEW OFFICERS

Northwest Electric Light and Power Association

The following elections and appointments were made at the recent Spokane convention of the Northwest Electric Light and Power Association:

EXECUTIVE COMMITTEE

P. A. Bertrand, general manager, Grays Harbor Railway & Light Co.
R. M. Boykin, vice-president, North Coast Power Co., Portland, Ore.
John B. Fiske, consulting engineer, Wash. Water Pwr. Co., Spokane, Wash.
S. R. Inch, vice-president and general manager Utah Power & Light Co., Salt Lake City, Utah.
O'dell McConnell, vice-president Helena Lt. & Ry. Co., Helena, Mont.
Geo. L. Myers, assistant to president, Pacific Power & Light Co., Portland, Ore.
W. R. Putnam, vice-president and general manager, Idaho Power Co., Boise, Ida.
H. L. Walther, division superintendent, California-Oregon Power Co., Medford, Oregon.

The vice-presidents for the various states were elected as follows:

Norwood W. Brockett, attorney, Puget Sound Traction Light & Power Co., Seattle, Wash., vice-president for Washington.
Geo. L. Myers, assistant to president, Pacific Power & Light Co., Portland, Ore., vice-president for Oregon.
S. R. Inch, vice-president and general manager, Utah Power & Light Co., Salt Lake City, vice-president for Utah.
O'dell McConnell, vice-president Helena Light & Railway Co., Helena, Mont., vice-president for Montana.
W. R. Putnam, vice-president and general manager, Idaho Power Co., Boise, Idaho, vice-president for Idaho.

The election of Franklin T. Griffith as president of the Association was announced in an earlier issue.

Synchronous Club Opens Season

The first meeting of the Synchronous Club of Los Angeles for the new term was held in the auditorium of the Edison Building on Sept. 14. The subject for the evening's discussion was single phase motors, the principal speaker being H. D. Easterbrook of the Westinghouse Electric & Manufacturing Company, who spoke on "Development and Peculiarities of Fractional Horsepower Motors." He commented on the insistent demand for motors of this type and stated that there was plenty of room for some Western manufacturer to engage in this business. Quite recently a Los Angeles concern producing a small device asked for prices on 25,000 small motors, an order which could be handled to advantage by a local dealer. Many improvements in motor design were noted and discussed.

Tour of Industrial Plants in Bay Region Planned

A series of visits to the largest industrial establishments in the San Francisco Bay region is a part of the interesting and comprehensive program which is being planned by the executive committee of the San Francisco Chapter of the American Society of Mechanical Engineers. On October 7 the Union Iron Works of San Francisco will be visited, and a trip to the Mare Island Navy Yard for the purpose of visiting the super-dreadnaught "California" is scheduled for the early part of November.

This trip will probably form part of the grand celebration to be held on the fourth and fifth of November commemorating the fortieth anniversary of the national American Society of Mechanical Engineers. Plans are being made to connect local chapters by transcontinental telephone at this time, so that the speeches made at A. S. M. E. headquarters in New York will be heard by members of the society in all parts of the nation.

The officers of the San Francisco Chapter for the coming year have been elected as follows:

W. W. Hanscom, electrical and mechanical engineer, chairman; J. A. Kinkead, vice-chairman; J. G. DeRemer, consulting engineer, secretary; C. M. Gunn, president, Gunn, Carle & Company, San Francisco, committee member; R. A. Hudson, Hunter & Hudson, San Francisco, committee member.

WM. M. HAMILTON, Portland Railway Light & Power Company

"The important word in the industry today is 'action'—if we went home and put into effect one-fourth of what we preach, our difficulties would in large measure be solved."

—Northwest Electric Light and Power Association.

HAPPENINGS IN THE INDUSTRY

RECORD SIZE WATER WHEELS ORDERED FOR P. G. & E.'S PIT RIVER STATION

Two 40,000-hp. single runner, vertical shaft, hydraulic turbines and all generating equipment have just been ordered from Allis-Chalmers for the Fall River Station No. 1 of the Pit River development of the Pacific Gas & Electric Company. These will be the largest water wheels in the West, although of the same size as three placed in the Niagara Falls development. The Pit River turbines will operate under a higher head, however, being 425 feet.

The remainder of the generator equipment consists of two 35,000-kva. water-wheel generators for 90 per cent lagging power factor, 3-phase, 60-cycle, 11,000 volts, 257 r.p.m., with direct-connected exciters, and one 225-kw. motor-generator set. All the generating equipment represents an investment of about \$1,000,000. Delivery is promised to start in 9 months, ending in 11½ months.

Seven Westinghouse single-phase transformers have been ordered, 16,667 kva., oil insulated, water cooled, outdoor type, wound for 127,000 volts high tension and star-connected for 220,000 volts.

REGULATIONS GOVERNING APPLICATIONS FOR WATER POWER PERMITS

The Federal Water Power Commission has just completed rules and regulations governing the application for and granting of water power permits. There are ten regulations which cover the following heads: (1) Definition of terms, (2) general requirements for applications, (3) applications for preliminary permits, (4) applications for licenses—major projects, (5) applications for licenses—minor projects, (6) applications for licenses—major projects already constructed, (7) declaration of intention, (8) priorities and preferences, (9) permits, (10) licenses.

PROSPECT PLANT ADDITION OUTLINED BY CALIFORNIA-OREGON COMPANY

California-Oregon Power Company announces extensive additions to its present Prospect Plant on the upper Rogue River, Jackson county, Ore. Plans call for the construction of a concrete dam, one and one-half miles of canal and a forebay with a ten-acre surface area. A 3,000-ft. high-pressure pipe will conduct the water from this forebay to a new concrete and steel power house. Four units in the new plant will develop 20,000 kw. Financing of the project will be done probably by a bond issue early in 1921, following the reorganization plan recently outlined by the company.

NEW PUGET SOUND EIGHT PER CENT POWER ISSUE SELLS RAPIDLY

Five year 8 per cent gold coupon notes to the extent of \$1,000,000, dated Sept. 1, 1920, have been placed on the market by the Puget Sound Power & Light Company, Seattle, Wash. These notes are the direct obligation of the company, and come ahead of the \$14,793,000 of preferred stock and \$20,112,000 of common stock. Offering is made in denominations of \$100, \$500 and \$1000 at face value and accrued interest, and interest is payable the first of March and September.

By the morning of Sept. 16, \$530,000 of the issue had been sold locally, expectations having been exceeded in all districts. It is expected that the sale will be limited shortly to a small number of shares per person in order that all may be satisfied. Time allowance has been given by the company for payment, but it is found that little advantage is taken of this feature.

For the twelve months ending July 31, 1920, the company states that it has earned, after deducting all operating costs, taxes and prior charges for interest on mortgage debt, \$2,096,970. The outstanding capital of the company, with the new issue, will be \$75,395,500. In the intention of the company to meet the increasing demands for power, it has been found necessary to make this new issue, the proceeds from the sale of which will stay in the Pacific Northwest.

TWO MORE WESTERN POWER APPLICATIONS FILED IN WASHINGTON

Six new applications for water power permits have been filed with the Federal Power Commission, and of this number two have been for developments in the West. The Priest Rapids Irrigation District has made application for a preliminary permit to develop power on the Priest Rapids of the Columbia River, filed under W. J. Kincaid of White Bluffs, Wash. This is the second application filed for Priest Rapids. The other Western one is by the Tongass Pulp & Paper Company, under M. M. Lyter, attorney, Alaska Building, Seattle, Wash., for a preliminary permit to use Fish Creek, Swan Creek, Big Lake, Mirror Lake and Swan Lake, in southeastern Alaska, for power purposes and authority to construct power plants, pulp and paper mills on Carroll inlet. A previous Alaskan application had been filed by the Speel River Power Company, 418 Foxcroft Building, San Francisco, for a site in the vicinity of the Speel River, in the Tongass National Forest.

It is interesting to note that the first applications for licenses to be advertised by the Federal Power Commission are those of the Ford Motor Company at Troy, N. Y., and of the state of Illinois for the use of the waters of the Des Plaines and Illinois Rivers.

P. G. & E. RUSHES NEW 60-KV. TIE LINE

In order to complete the tie-in before snow flies, the Pacific Gas & Electric Company is rushing work on its new 60,000-volt line from the Drum power house to the Colgate power house, above Nevada City, California. An appropriation of \$250,000 has been made for the improvement, and a camp has been established near Birchville.

SOUTHERN CALIFORNIA EDISON COMPANY RATE CASE CONTINUED

In response to the date fixed by the Railroad Commission, the Southern California Edison Company made its appearance on Sept. 16 in the Los Angeles office of the Commission in the matter of establishing permanent electric rates, which is a continuation of the case in which a 27 per cent surcharge was imposed in order that the company might be saved from the great losses threatened by the water shortage of this spring.

Commenting on the company's progress for power development, R. H. Ballard stated that new hydroelectric plants aggregating 92,000 horsepower would become available during 1921; that these new plants would produce 350,000,000 kilowatt-hours annually, this being about the amount now carried by the company's steam plants; that the cost of these new installations with distributing lines was approximately \$25,000,000 and that the average interest rate paid by the company for this money was 7½ per cent.

According to Mr. Ballard further immediate developments in the Big Creek country, in addition to the above, will call for a further expenditure of \$45,000,000, this program including the 13-mile tunnel to connect Florence and Hunting-

ton lakes and improvements in the Shaver Lake district, where a reservoir of 146,000 acre-feet storage will be provided. This portion of the program will yield another 150,000 horsepower.

Some interesting figures on reproduction costs were presented by Arthur Kelley, valuation engineer. He stated that the actual cost of the Edison property amounted to \$96,300,000 whereas the cost to reproduce the property on present day values, less depreciation, would be \$128,731,000.

CONDITION OF PRELIMINARY WORK ON SKAGIT RIVER PROJECT

A recent survey of the work already done at the Skagit River power project in the state of Washington shows that work has been completed on the sawmill, which has a capacity of 20,000 ft. daily; two camps have been built, accommodating 200 men, and work is being rushed on the new railway extending from Rockport to Marblemount. All of the work is preliminary to actual construction work on the Gorge Creek power house and dam, which will be started early in the spring. If the first power unit is built in accordance with present plans, the cost of the unit, according to hydroelectric engineer C. F. Uhden, will be: with high dam, giving daily storage, 60,000-kva. installation and single transmission line, \$11,000,000; with low dam, no daily storage, 60,000-kva. installation and single transmission line, \$8,000,000; with low dam, no daily storage, 40,000-kva. installation and single transmission line, \$7,000,000. The cost of the kilowatt-hours delivered on high tension at Seattle under the first plan would be 0.43 cents, under the second plan, 0.52 cents, and under the third plan, 0.45 cents. This price is said to be approximately one-half the present cost of current in Seattle. It is now stated by Mr. Uhden that, barring unforeseen delays, current will be available in Seattle from the Skagit plant in 1923. Expenditures up to June 21, 1921, are estimated at \$1,832,820.

SKIP STOPS INSTITUTED IN SAN FRANCISCO TO SAVE POWER

That the curtailing of power through the cutting down of sign and display lighting is not sufficient in the present power shortage in California is evidenced by further regulations to effect an immediate reduction in power consumption in San Francisco. Beginning Sept. 20, street car companies in that city instituted a complete skip-stop system of operation similar to that in effect during the war. It is even considered that this saving will not be sufficient to meet the gravity of the situation, and that reduction in car service on many lines will be necessary. In certain down town districts street lighting has been cut down considerably.

PLANS READY FOR CITY OF SEATTLE'S CEDAR FALLS POWER HOUSE

The completion by the city architect of plans and specifications for the new Cedar Falls power house, designed to accommodate the necessary machinery to develop 20,000 hp. of additional power, marks the last step preparatory to beginning actual construction work of this much-needed unit, figured to cost \$1,000,000.

The new concrete and steel structure will adjoin the present power house below the falls and is to house a Pelton overhung turbine, driving a Westinghouse generator. Transformers will be used to step the voltage up to 60,000 volts for transmission. This is the first unit of large size to be installed under the new system designed by superintendent J. D. Ross, by which the generating unit and the transformers are considered as an inseparable unit without intermediate switches and busses. This same system is to be used at the Lake Union steam plant.

In addition to the equipment to be installed in the power house, much outside work is to be done. On the intake side of the unit and joining the present 1600-ft. tunnel, there will be constructed 5305 ft. of wood stave pipe, 6 ft. 6 in. in diameter, and joining this, where the pressure becomes greater because of a fall in elevation, will be placed 2200 ft. of 6-ft. 6-in. steel pipe. These pipes will be placed above ground.

Following the approval of the plans by the board, no time will be lost in issuing calls for bids for the construction of the building and the other necessary work, incident to putting the unit in operation at the earliest possible moment.

P. G. & E. ASKS RATE INVESTIGATION

Pacific Gas & Electric Company on Sept. 21 filed with the California Railroad Commission an application for an investigation of the rates and fares charged by the company in the operation of its system of street railways in the city of Sacramento, Cal., and for an order establishing such rates and fares as will yield the company a fair and reasonable return upon the value of its street railway properties. The company claims for these properties a value in excess of \$2,449,285. This is exclusive of franchise or going concern value and development costs.

The company says that during the fiscal year ending June 30, 1920, the gross revenue of the street railways in Sacramento amounted to \$727,647.85. The operating expenses for the same period, according to the company, amounted to \$596,073.81, leaving the sum of \$131,574.04 available for depreciation and return.

COAST STATES HAVE RADIO SERVICE TO JAPAN

On Sept. 1, the Radio Corporation of America extended its Japanese radio-telegraph service from its former San Francisco district to the entire states of California, Oregon and Washington and to British Columbia. The rates for such service will be the radio rate of 72 cents a word between San Francisco and Japan plus the telegraph service of the Western Union from points outside of the San Francisco sending station. In addition the company is inaugurating a press service at one-half the straight radio rate. Marine radio service in and around San Francisco will be handled by the new marine station which the company is opening at Bolinas, just north of San Francisco.

POWER DEVELOPMENT PROJECTED ON LOGAN RIVER, UTAH

A project for the utilization of the flood waters of the Logan river, Logan, Utah, collected during the spring high waters, is contemplated within the next two years, to irrigate lands on the east side of Cache county and also to supply ample water for the operation of power plants that may be idle or operating with a short supply of water for part of the year.

This would involve the construction of a dam across the left-hand fork of Logan river, about twenty-one miles above Logan city. The dam would be about 210 feet high at this point, for the storage of about 35,000 acre-feet of water, and would cost about \$2,500,000.

Preliminary steps are being taken toward the formation of an irrigation district covering the area affected, and all unappropriated waters of the Logan river have been withdrawn from entry by the state engineer for the next two years.

J. R. TOMLINSON, Pierce-Tomlinson Electric Company, Portland—

"The contractor-dealer has gone about as far as he can alone—as any one branch can develop without the others."

—Northwest Electric Light and Power Association.

P. G. & E. RENTS ALAMEDA MUNICIPAL PLANT TO HELP RELIEVE POWER SHORTAGE

The Pacific Gas & Electric Company has added 1500 kw. to its lines by the starting up on Sept. 17 of the Municipal Electric Light plant in Alameda, Cal. An agreement has been reached whereby the Pacific company pays the costs of putting the Alameda plant into service and all costs of operation, and in addition pays a rental charge of \$100 a day. This latter charge, however, may be reduced following a conference set down for the last of September. The Municipal company will operate the plant.

While this new service is not being applied directly to the Pacific company's lines, it is fed into the lines of the Great Western Power Company, and this company in turn releases an equivalent amount to the Pacific company at points where it is needed most. At present from 30,000 to 35,000 kw-hr. per day is being added to the lines.

The Municipal plant had been shut down for nearly two years, purchasing its power from the Great Western because of economies effected by that procedure, but was put back in operation for this new run in six days. Its operation under present conditions is only temporary, pending relief from the power shortage.

3,828,982,000 KW-HR. PRODUCED IN WEST DURING FIRST SIX MONTHS OF 1920

Figures on the production of electric power and consumption of fuel by public utility power plants in the Western states for the first six months of the present year have just been made public by the United States Geological Survey. Records are given for each state in the Union, but only those of the eleven Western states have been compiled in the summary given below.

Total production of public utility power plants for that period amounted to 21,846,515,000 kw-hr., which is at a yearly rate of 43,693,030,000 kw-hr. Figures for the first half of 1919 are given by the Survey as 18,779,250,000 kw-hr. Of the first amount, Western states listed in the table produced 3,828,982,000 kw-hr., or 17.5 per cent of the total for the country. One-fifth of this power was produced by fuels and the remainder by water power.

An interesting point comes to light in this connection in that 75 per cent of the power produced by wood as a fuel is produced in the West; that section generated 7,753,934 kw-hr. of energy by wood-burning for the six months through June out of a total in the country of 10,329,306 kw-hr. The

West produced 37 per cent of the total energy produced by water and 5.65 per cent of that produced by fuels. It consumed 2 per cent of the coal that was required to produce public utility energy throughout the country, 11.6 per cent of the natural gas and 47 per cent of the petroleum and its derivatives.

The quantities in the table are based on national returns received from about 3,000 power plants of 100-kw. capacity or more engaged in public service, including central stations, electric railways and certain other plants which contribute to the public supply. The capacity of plants submitting reports of their operations is about 90 per cent of the capacity of all plants listed with the Geological Survey.

BASIS OF SEATTLE LIGHT WARRANTS RAISED

Seattle light department warrants have gone on a 6 per cent basis. They have been on a 5 per cent basis, but City Comptroller Harry W. Carroll states that the condition of the financial market at the present time makes the increase necessary. The banks of the city have advised the city council and light department that the present financial market requires a 6 per cent bearing warrant, and calls attention to the fact that the Government is issuing Treasury notes bearing 5½ per cent, and commercial paper is drawing 8 per cent. The light fund is overdrawn at the present time, and will probably remain in that condition until March, 1921.

CONVENTION OF WATER POWER LEAGUE IN WASHINGTON, D. C., IN OCTOBER

In order to give the representatives of the various states interested in water power an opportunity to meet with the Federal Power Commission, the Water Power League of America has invited producers of water power, users and prospective users of water power, state officials and others interested in the subject to attend a convention in Washington, D. C., on Oct. 7 and 8.

Among the subjects to be discussed will be "Financing Under the Federal Power Act," "The Advantages of the Federal Power Act From the Standpoint of the Practical Developer and Operator" and "Cooperation Between the Power Producer and the Federal Power Commission." "What the Farmer Expects From Water-Power Development" will be discussed by a representative of the National Grange. In addition, O. C. Merrill, executive secretary of the Commission, will present the federal water power act, W. S. Murray will discuss the Eastern super-power zone survey, and related questions of drainage, forestation, etc., will be covered.

PRODUCTION OF ELECTRIC POWER AND CONSUMPTION OF FUEL BY PUBLIC UTILITY POWER PLANTS IN THE WEST FOR FIRST SIX MONTHS OF 1920

	THOUSANDS OF K. W. H. PRODUCED BY				Short Tons of Coal	Barrels of Petroleum and Derivatives	Thousands of Cubic Feet Natural Gas
	Water	Wood	Fuels	Water and Fuels			
Arizona.....	55,156		25,692	80,848	2,400	121,035	0
California.....	1,219,179	572.	527,900	1,747,079	0	2,738,852	1,164,943
Colorado.....	83,489		111,685	195,174	219,855	712	0
Idaho.....	292,614	50.	1,138	293,752	410	40	0
Montana.....	572,351		3,170	575,521	24,716	224	6,666
Nevada.....	18,446		4,851	23,297	1,395	8,069	0
New Mexico.....	403		6,478	6,881	21,176	2,639	0
Oregon.....	188,299	6,466.	43,183	231,482	1,783	9,050	0
Utah.....	93,669		56	93,725	138	0	0
Washington.....	537,537	664.	18,566	556,103	19,608	57,785	0
Wyoming.....	997		24,123	25,120	71,031	46,162	18,420
Total, West.....	3,062,140	7,753.	766,842	3,828,982	362,512	2,984,568	1,190,026
Total, U. S.....	8,274,293	10,329.	13,572,222	21,846,515	18,785,851	6,361,701	10,258,673
Per Cent West to U. S.....	37	75	5.65	17.5	2	47	11.6

WESTERN CITIES TO GUIDE MAIL PLANES BY WIRELESS ILLUMINATION

In connection with the obtaining of electric power from the Utah Power & Light Company for the operation of the radio station to be established in Salt Lake City, it was stated by Colonel John A. Jordan, superintendent of the Western division of the air mail service, that small electric lights operated by wireless placed on the front of the machines will guide the planes at night on the transcontinental air mail route between Cheyenne, Salt Lake City and San Francisco.

"The lights will be tuned to the wireless instruments of the three cities in such a manner that they will shine only when the planes are within a certain radio path about 200 feet in width. When a plane strays from this path the lights will go out and the pilot will be obliged to determine by the wind on which side of the route he is traveling. Approach to the destination will be signified by a flashing on and off of the lights. The process has proved a success in thorough tests and is owned by the government," said Colonel Jordan.

NEW MEXICO CENTRAL STATION TO SUBSTITUTE HOGGED FUEL FOR COAL

In substituting for coal in central stations, hogged fuel has just gained another step. The Albuquerque (N. M.) Gas & Electric Company is installing two additional boilers and conveying apparatus, at a cost of \$50,000, to use hogged fuel obtained at a nearby sawmill and hogged at the station plant. Coal will be burned only when there is not sufficient sawmill refuse. Last year the 21,000-kva. station produced 3,800,000 kw-hr. with a consumption of 11,000 tons of coal, much of which it is expected will be saved by the changes.

REGIONAL WATER POWER OFFICE DESIRED BY NORTHWEST ENGINEERS

There is a good deal of agitation among engineers of the Northwest to have their own regional office to handle applications on behalf of the Water Power Commission and to perform other duties under the new federal water power act. It is held that Seattle or Portland are more logical cities in which to have regional headquarters than is San Francisco, from which city at present all such Pacific Coast business is handled. There is no desire in the Northwest to eliminate San Francisco as a center but to add a Northwest region.

California has only 49.4 horsepower of hydroelectric energy per square mile available, while Washington has 125 potential horsepower per square mile, Oregon has 68.4 and Idaho has 60.4 horsepower. At the same time no consideration is taken of Alaska with its large resources in hydroelectric energy. Seattle seems to be the logical center for Alaskan business if only cities in the States are considered.

BOULDER CANYON SITE PROPOSED FOR IRRIGATION AND POWER DEVELOPMENT

The building of a \$20,000,000 dam in Boulder Canyon, with a capacity of 240,000,000 acre-feet of water, is comprised in a plan outlined by Arthur Powell Davis, director general of the United States Reclamation Service. The information comes from Governor Bamberger of Utah, on his return from the League of the Southwest conference in Denver.

Stored waters of Colorado tributaries would take in two areas of lands, and the dam would take care of 10,000,000 acre-feet of silt which is annually brought down the Colorado when the flood waters rush down. On the South Myton bench there could be placed under irrigation 65,000 acres with waters from the Duchesne basin and 240,000 acres of adjacent lands 27 miles north from Green River. About 290,000 hp. could be produced through water storage near Green River, while the power that could be taken from the Colorado has been estimated at 2,666,000 hp.

WIRING CODE FOR CITY OF SEATTLE REVISED

After several weeks' study by representatives of the Building department, the Seattle Electrical Sub-Contractors' Association, Journeymen Electricians, Building Owners and Managers' Association, and the Washington State Chapter of the American Institute of Architects, the electric wiring code for the city has been revised and has been referred to the Public Safety Committee of the City Council. The old wiring code now in effect was adopted in 1912, but was not presented to the council until two years later. Since then it has been revised in various ways. Most of the latest revisions relate to the details of wiring, requiring that they be in accordance with generally accepted standards. The following are among the more important changes:

The use of conduit instead of open wiring is required in more instances than is required in the existing code; that is, the existing code permits open wiring in frame apartment houses three stories high; these buildings are now required to have conduit.

Conduit and cabinets within 100 feet of salt water are required to be galvanized.

Exposed switches in panel boxes accessible to tenants are required to be protected by a safety device so that danger to life is obviated.

Eliminating open wiring on the roofs of new buildings in the first and second districts and on the roofs of other buildings in the first and second districts if dangerous.

It is believed that the economies balanced against the additional costs will show but slight addition in cost of installation and will add considerably to the safety and durability of the installation.

SOUTHERN CALIFORNIA EDISON ANNOUNCES FIFTEEN-YEAR PROGRAM

Announcement has been made by R. H. Ballard, vice-president of the Southern California Edison Company, of a fifteen-year program for that company, involving the expenditure of \$200,000,000 in the development of 750,000 horsepower from the Kern and San Joaquin rivers, Big Creek and Huntington, Shaver and Florence lakes. The Kern River program calls for a 40,000 horsepower plant, the addition to the Big Creek plant is 22,000 horsepower and a new 30,000-horsepower plant is proposed on Big Creek for early next year. Mr. Ballard brought out the necessity of developing 50,000 horsepower additional energy each year to keep abreast of the estimated demands for service.

TACOMA COMMISSIONERS PROTEST REQUEST OF UTILITY TO REDUCE PROPERTY VALUATION

The city commissioners of Tacoma, Wash., recently protested before the State Board of Equalization the request of the Tacoma Railway & Power Company for a reduction of \$1,000,000 in the valuation of its property within the city limits of Tacoma. It is the belief of the city officials that between \$30,000 and \$40,000 will be saved to the city on its tax income by the protest. Commissioner Fred Shoemaker, in discussing the company's request, says that if any change is made this year in the valuation of the company's property, it should be in the direction of an increase. "They offered to sell the property to the city of Tacoma for \$6,500,000," he stated, "thereby setting a market valuation for their holdings, and the state public service commission in granting a 10-cent fare recently, calculated to allow the company an annual interest of 8 per cent on its investment. Actual assessment valuation on their property is \$3,000,000, and in levying taxes the commission reduces that by half, leaving a tax levy on but \$1,500,000. In my testimony before the Equalization Board, I tried to show that the average property owner of Tacoma is paying taxes on 50 per cent of the market value of his holdings." City officials believe the board will take favorable action in the matter.

D. E. HARRIS, vice-president and sales manager, Pacific States Electric Company—

"We must substitute self-interest for selfishness—a very different thing."

—Northwest Electric Light and Power Association.

LATEST IN EVERYTHING ELECTRICAL

(Nothing can be more convenient than a convenient lamp. That is why every improvement in this line is welcomed by electrical dealers and their customers. The portable lamp with the adjustable joint described here as well as the announcement of a new conduit body line especially designed to avoid kinking of heavy wires are of interest. Eight hundred and seventy copies of Mr. Kennedy's book, "Winning the Public," have been sold within a month and for that reason the review appearing on this page is of more than usual import.—The Editor.)

THE ADDITION OF AN ADJUSTABLE JOINT

The already convenient portable lamp has been improved by the addition of an adjustable joint at the base and at the upper end of the arm. The Faries Manufacturing Company, originators of the well known portable lamp, No. 1012, are responsible for this improvement.

As may be seen in the illustration, the lamp is made in five pieces, the iron base with felt on the bottom, the heavy brass shell which covers the canopy and the three-piece stem made with a one-piece joint. The above illustration of the one-piece joint shows how the heavy tubing is split and straightened out, making the joint practically as substantial as the tube itself.

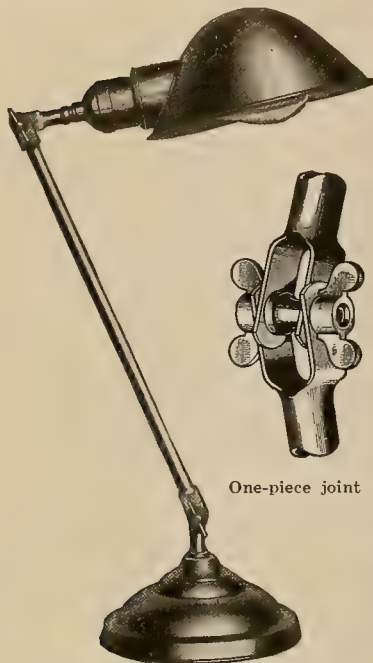
The arm of the portable is made in three pieces, the short arm at the socket end, the center stem, and the third piece fits into the iron base and swivels on the base. This swivel on the base in connection with the adjustable joints permits the light to be thrown in any position. The shade shown on the cut of the portable itself also swivels, so that the light may be adjusted to any angle.

NEW CONDULETS

To meet the demand for a conduit having an unusually long cover opening and big wiring chamber, the Crouse-Hinds Company of Syracuse, N. Y., have designed a new series known as the new Mogul Series of Condulets which are now being shown in their Bulletin No. 1000-N.

These condulets are designed to avoid kinking heavy wires or cables when pulling in or feeding through a conduit system, and to afford ample space for making splices or taps. Furthermore, these condulets though liberal in their proportions do not materially affect the general outline of the conduit system. Their hubs have integral bushings and tapered threads. Fastening screw holes are located at the ends of the cover openings.

Mogul Condulets are made in eight types, each type in eight conduit sizes ranging from one to four inches. There are four sizes of composition and cast iron covers, each size being common to two sizes of Mogul Condulet bodies. The composition covers are made with from one to nine wire holes; also blank, which can be drilled by the user as required. The cast iron covers are made in two types; with gasket, or without gasket. The gasket is made of round rubber cemented into a groove in the cover. The cover fastening screws are furnished with and secured to the cover.



The portable lamp of the Faries Manufacturing Company as it appears with the new adjustable joint.

Books and Bulletins

"WINNING THE PUBLIC"

By S. M. Kennedy, vice-president in charge of Public Relations and Business Development, Southern California Edison Company; 168 pp., 6 x 9 in. Published by the McGraw-Hill Book Company, Inc., 239 West 39th St., New York, and on sale by the Journal of Electricity, 531 Rialto Bldg., San Francisco. Price \$2.50.

"The public be damned" is a dead policy, and nowhere is the broader policy of conciliation more clearly exemplified than in the practice of the modern utility concern. The good-will of its customers is looked upon by the progressive power company not merely as an eminently desirable adjunct, but as a definite business asset, and the subject of public relations now has a recognized place in the company's program.



This new spirit, in all its various aspects, is voiced in a remarkable way in Mr. Kennedy's unique book. Published as a series of articles in the Journal of Electricity recently, this work aroused the interest of the entire electrical industry and called forth expressions of approval from all over the country. The demand was so great that it was decided to issue the articles in book form, and the resulting volume, recently off the press, is one which should find a place with every business house, and especially with every public service company.

The subject is treated with a thoroughness which will make the book the standard work on this aspect of public utility development. Every avenue of contact between the company and its customers is covered—from telephone calls to advertising, from managerial interviews to meter reading. The book is absorbing reading throughout, and is written with a human touch which drives home as nothing else could, the reality of the personal element in business.

Appraisals and Rate Making

This booklet, by Cecil F. Elmes of the Sanderson & Porter engineering staff, is a publication of the address under that title which was given before the fifteenth annual convention of the Illinois Gas Association.

Such questions as the following are adequately discussed: Why should rate making be different in the case of a thousand feet of gas from the same problem in regard to a bar of soap? What is the service which the public utility renders? On what basis are we to compute a fair return to the investor?

Sections are devoted to a discussion of the relation between prices of commodities and between commodity prices and wages as well as to the present purchasing power of money and rates and rate of return as judged by the purchasing power of money.

NEW ELECTRICAL DEVELOPMENTS

(Of the four districts represented on this page, four report some phase of dam construction. The Northwest also announces the installation of a large radio commercial station on Puget Sound while noteworthy financial and construction news comes from the Pacific Central District. The Southwest and Intermountain districts plan the construction of lighting plants and street lighting systems.—The Editor.)

THE PACIFIC NORTHWEST

BANDON, ORE.—A slight increase in the rates of the Bandon Power Company was recently granted in an order issued by the Oregon Public Service Commission. Figures submitted showed that the company, for the period of Jan. 1 to July 1, 1920, operated at a net loss of \$4,456.16. The new rates became effective Sept. 1.

SPOKANE, WASH.—The Spokane & Eastern Light & Power Company recently announced wage increases, effective Sept. 1, amounting to \$100,000 a year, affecting more than 500 employees in both the power and lighting and street railway divisions. It is stated the increase will add from \$12.50 to \$17.50 per month to the wages of every employee, except street car conductors and motormen.

SEATTLE, WASH.—The Board of Public Works has approved the plans of Architect Daniel Huntington for the new \$60,000 addition to the Cedar Mills power house, and the structure will be contracted for without delay. The machinery, including turbines, transformers and generator will arrive in Seattle about December 20th, and it is intended to have the structure completed to receive them. All work aside from construction of the building will be done by day labor.

PORTLAND, ORE.—The Public Dock Commission has prepared plans and specifications for furnishing and installing all the mechanical equipment for the 15,000-ton floating drydock now under construction. This equipment included 10 single stage centrifugal pumps, 4 electrically operated capstans, flood gates, sluice gates, valves and stems. Bids will be called for the work, and also for ten 100-hp., 440-volt motors. The date for closing bids has not been fixed.

SEATTLE, WASH.—Announcement has been made by W. F. McAuliffe, local manager of the Radio Corporation of America, that his company plans the early installation of a radio commercial station, estimated to cost approximately \$30,000, on Puget Sound, possibly within the city limits of Seattle. The station will be used for marine work. Mr. McAuliffe states that commercial stations similar to the one contemplated in Seattle will be established at all the principal ports of the Pacific Coast.

SALEM, ORE.—Application has been filed in the office of the state engineer for a permit to construct a reservoir and to appropriate water for power development on the south fork of the Coquille River, by M. J. Anderson of Portland, Ore. The development contemplates the construction of a reservoir for the storage of 18,700 acre-feet of water, a tunnel and pipe line approximately three miles long, and appropriation of 75 second-feet of water under a head of 1,556 feet, which will develop approximately 13,000 theoretical horsepower.

SALEM, ORE.—The Sacramento-Klamath Water, Land and Power Company, through Victor de Marais and Charles E. Watson, of Sacramento, has applied to the state engineer for permission to divert 4,000 sec.-ft. of water from Klamath River for irrigating 250,000 acres of land, for developing 150,000 hp. and for domestic supply. The amount represents the total flow of Klamath River yet unappropriated. Construction will include a dam of concrete,

rock and timber, 30 ft. high and 300 to 400 ft. in length, headgate and power plant at Cantara, California. Work is to be started within 60 days after permit is granted; total cost estimated at \$15,000,000.

THE PACIFIC CENTRAL DISTRICT

ROSEVILLE, CAL.—Engineers are surveying a site for a dam to form a reservoir in the hills east of this city to hold sufficient water for the irrigation of 12,000 acres of land near Roseville.

EUREKA, CAL.—The indications now are that the Western States Gas and Electric Company soon will be getting its power from a source considerably nearer and much handier than that of Junction City on the Trinity river. The proposed new power site is located on the Klamath river, five miles below Martin's Ferry.

ORLAND, CAL.—Various plans were discussed at length for improving the water supply of the project at the meeting of the West Side Water Users' Club at the Murdock school. Among the plans suggested were the installation of four wells and pumping plants along the main canals just west of town, using the storage water for the lands to the west of town and the water supplied by the pumps for the land to the east of town.

RICHMOND, CAL.—The new paint factory of the Certain-Teed Products Company in this city has commenced operation of grinding and has added another industry to the city. The plant was constructed as a special unit at an expenditure of more than \$200,000, and is said to be one of the most modern in America as the company profited by its experience with its plants in various parts of the country. The local factory will supply the Pacific Coast and Oriental trade.

SAN FRANCISCO, CAL.—An order issued by the Railroad Commission gives the Pacific Telephone & Telegraph Company and all other telephone companies operating in the state authority to retain funds collected from subscribers for installation and extension charges. In granting the request after an investigation as to the costs of installation, etc., the Commission says that moneys collected as installation charges from subscribers between August 1, 1919, to August 1, 1920, must be returned but that charges collected after August 1 of this year may be retained by the company.

GRASS VALLEY, CAL.—The Delhi Mining Company, owner of the noted Delhi mine in the Columbia Hill section, is installing a hydroelectric plant for the purpose of utilizing surplus water rights. Water will be taken from Bloody Run and other streams and passed through a penstock at a point where there is a heavy fall. Two generators of electric energy are to be installed in connection with a standard hydroelectric plant. It is stated that the company has contracted to supply 1000 kilowatts of electric energy to the Pacific Gas & Electric Company, beginning the first of next June. Harry Skewes of Grass Valley is superintendent of the Delhi.

SAN FRANCISCO, CAL.—The comparative statement of earnings of Mount Whitney Power and Electric Company for the half-years ended June 30, 1920, and June 30, 1919, was made public recently by Blyth, Witter & Co. It shows

that earnings available for bond interest amounted to 3.3 times the requirements, and an increase of 32 per cent over the first half year of 1919. Balance, after interest charges, showed an increase of 54 per cent. Announcement was made to the effect that the time limit of the certificate issued by the State Banking Commissioner making the 6 per cent bonds of this company a legal investment for savings banks in California has been extended to March 31, 1921.

THE PACIFIC SOUTHWEST

SAN PEDRO, CAL.—A decision has been unanimously made that a bond issue be called for \$300,000 to be voted on for the new electric line at Wilmington.

LOS ANGELES, CAL.—The first contract for Big San Dimas Dam, to cost about \$369,000, has been let to Dent Bros. after bonds had been sold to the extent of \$200,000 to R. H. Moulton & Co.

LOS ANGELES, CAL.—Neptune Meter Company has been awarded a contract for furnishing the bureau of light and power 6,600 meters, and James Jones Company a contract for furnishing 13,600 bronze water meter connections.

ARLINGTON, CAL.—C. Ramschel of the Southern Sierras Power Company suggests a plan for taking care of the shortage of irrigation water in the Perris district by installing a series of pumping plants east of the artesian belt in the Lakeview section to pump water into a canal and permit its flow by gravity into Perris Valley. The matter is being considered by a committee of the Chamber of Commerce.

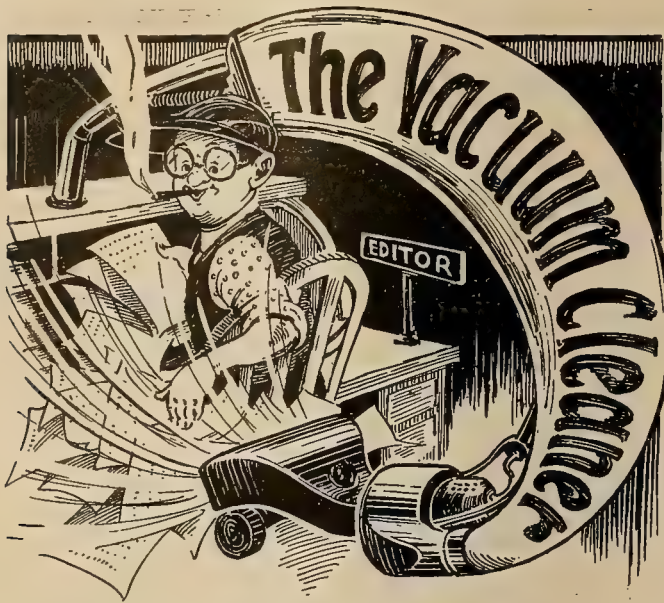
THE INTER-MOUNTAIN DISTRICT

JULESBURG, COLO.—The electric light and power line connecting the town of Big Springs with the light and power plant of Julesburg has been completed.

ROUNDUP, MONT.—The city plans the construction of an ornamental light system along the streets which are being paved, at a cost of \$25,000. A special improvement district for installation of the lighting system was created some months ago.

MORGAN, UTAH.—The public utilities commission of Utah has granted a certificate of convenience and necessity to the Utah Power & Light Company through the city of Morgan to serve proposed customers beyond the city from the present power lines.

MALTA, IDAHO.—At a general mass meeting held at Malta recently, the developments possible in the great Raft River Valley were discussed. With an unlimited supply of underground water immediately available by pumping an average of 14 to 20 feet, the question of raising sugar beets by means of electric pumping for irrigation was discussed. Some information was also given by a representative of the Burley Electric Company relative to electrical energy for the valley. It was asserted that power is available if a means of financing the construction of a line could be had. A committee was appointed to investigate, and as soon as they report their findings steps will be taken toward pushing to successful completion the work begun.



To simplify transportation, the following changes in the routing of cars have been announced by the Tokyo Municipality Electric Bureau: "Shio-cho, Yotsuya to Sengakuji and Furukawa-bashi to Sengakuji lines to be abolished and the Shio-cho to Sengakuji and Tengenji-bashi to Kanasugi-bashi lines to be operated."

Very much simpler.

Everybody is quoting the following, so we may as well do it at once and get it over:

"Getting out a newspaper or monthly publication is no picnic. If we print jokes, folks say we are silly—if we don't they say we are too serious. If we publish original matter they say we lack variety—if we publish things from other papers, they say we are too lazy to write. If we don't go to church we are heathens—if we go we are hypocrites. If we stay in the office we ought to be out rustling news—if we rustle for news we are not attending to business at the office. If we wear old clothes we are slovens—if we wear new clothes they are not paid for. What in thunderation is a poor editor to do, anyhow? Like as not someone will say we swiped this from an exchange. So we did!"

* * *

"Music for the masses" is all very well as a slogan, but when it comes to someone getting delirious and inserting in a foreign trade magazine

"American importers are interested in an unlimited quantity of harmonicas"

—well, we are for rigorous import duties on luxuries.

* * *

Hustle isn't an exclusive characteristic of New York, apparently. A plaintive item in the Western Electric News reads as follows:

What Is the Wild West Saying?

"Rush our shipment—."

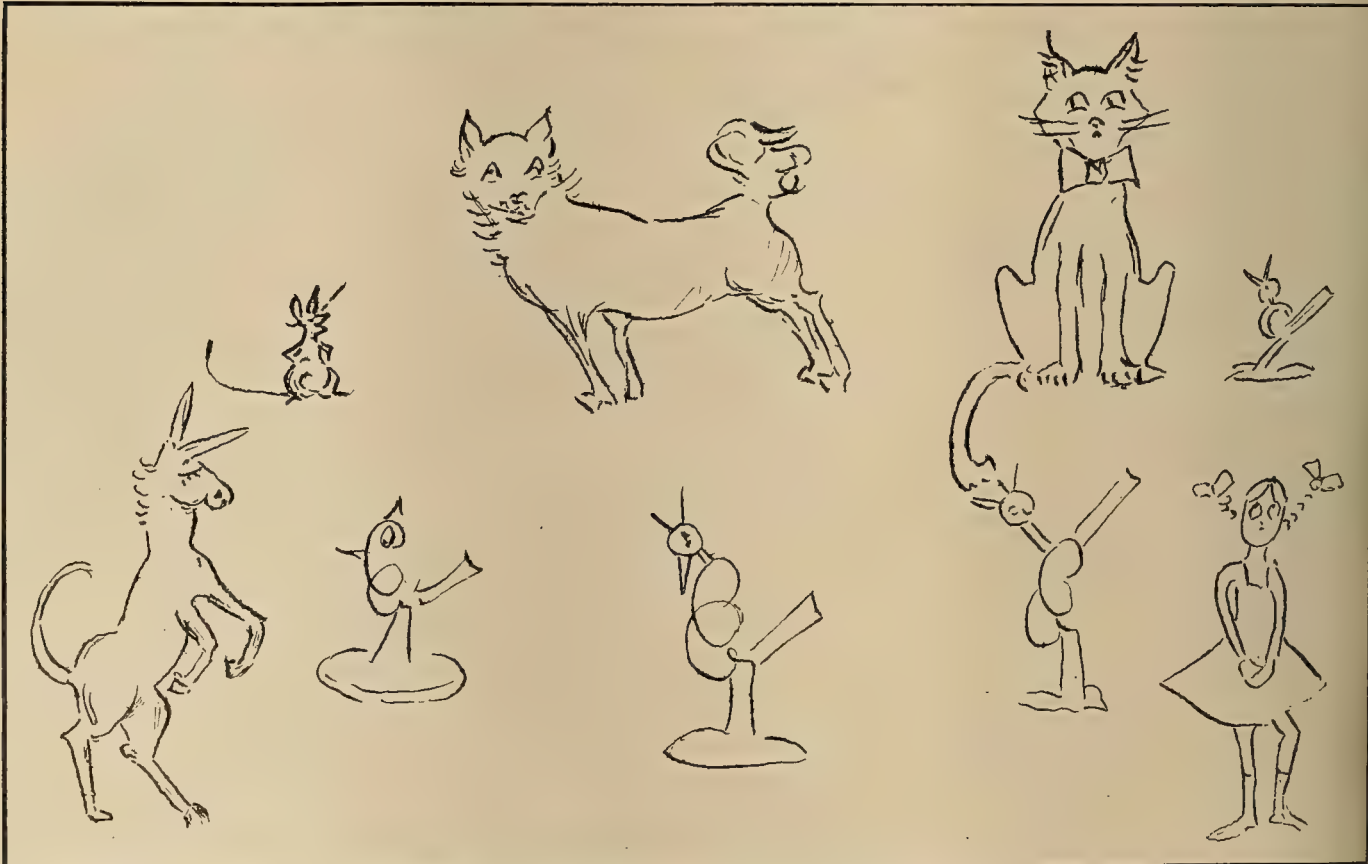
"Urgent; wire answer—."

"Please observe schedule—."

"Trace shipment—."

"Wanted urgently—."

If we took our favorite florist's advice and "said it with flowers," there wouldn't be any poison oak left in California.



ECHOES OF THE CONVENTION

At first sight these don't seem to have very much to do with the Spokane convention, but they happen to be bona fide reproductions from the notebook of a reporter. The association of ideas is somewhat difficult to follow, and we are not good at psycho-analysis, but the expression, of the cat at the right was probably seen on the face of a delegate watching a spider crawl round his neighbor's collar. The sketch in the lower left-hand corner seems to be some heraldic device—a donkey-engine rampant on a magnetic field, perhaps. The inspired lady at the right is somewhat difficult to tie-in with anything the reporter could have seen during convention, but may typify the expression of a speaker trying to look unconscious while the chairman introduces him.

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SAN FRANCISCO, OCTOBER 15, 1920

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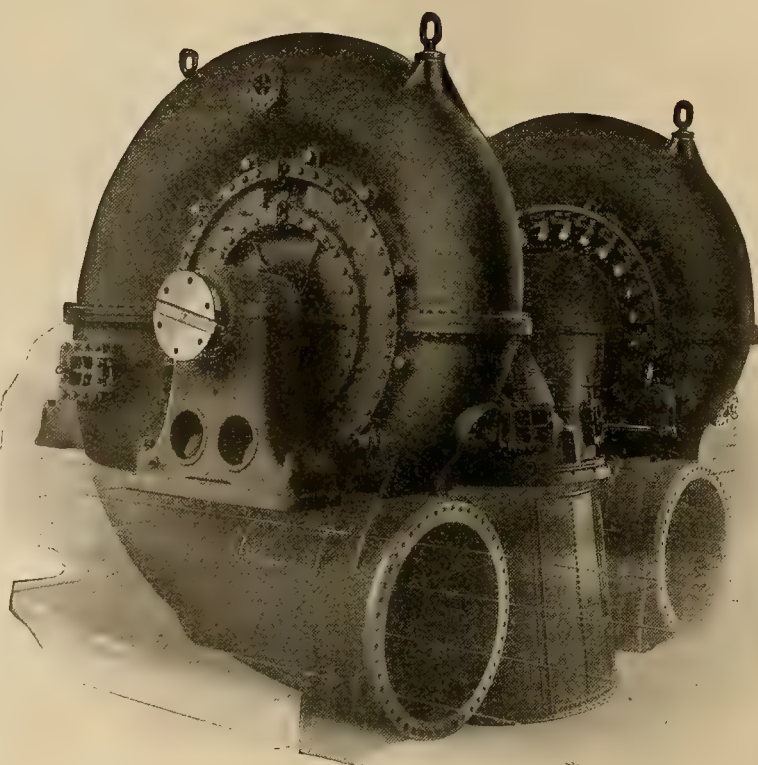
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at Niagara Falls



The above illustration shows the Ontario Power Plant, at Niagara Falls, Ontario, of the Hydro-Electric Power Commission of Ontario, Toronto, Ont. In the new addition at the right are installed two horizontal shaft 20,000 H. P. turbine units, one of which is shown below.

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JOURNAL OF ELECTRICITY

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SAN FRANCISCO, OCTOBER 15, 1920

NUMBER 8

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JOURNAL OF ELECTRICITY



DEVOTED TO THE UPBUILDING OF THE ELECTRICAL INDUSTRY IN THE WEST
AND IN THE COUNTRIES BORDERING THE GREAT PACIFIC

Volume 45

SAN FRANCISCO, OCTOBER 15, 1920

Number 8

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Keeping Engineering Leadership in the West

Q To the skill and daring of its engineers, the West owes much of the record of its achievement along all lines of agricultural, industrial and scientific development. In the close dependence of its future upon the use of its water powers and the electrical service of its industries and farm lands, it is still to the engineer that the West must look for the leadership in its advancement.

Q The development of engineering schools, therefore, which shall rank second to none and which shall produce men with the training and the vision to carry on the work of harnessing the great natural resources of the West is a primary requisite, if this region is to follow along the lines of great achievement which its pioneers have established.

Q Unfortunately western universities, and in particular the scientific and engineering schools of these universities, have suffered somewhat from the post war period of high costs, increased enrollment and tremendous industrial development which have called men from the university ranks with offers of salaries commensurate with their technical training. The electrical industry has viewed this gradual weakening with some concern and has been one of the first

to criticize in specific instances where it has felt criticism was due.

Q In all justice to the universities, however, it must be said that their deficiencies have in most instances been due to a lack of funds created by a suddenly doubled enrollment, together with a system of financing which was designed to meet conditions of an earlier period. Such a situation has led the University of California to apply for a new method of financing which shall provide a steady income proportionate to the wealth of the state and therefore roughly proportionate to the demands made upon the University. This measure will appear upon California ballots this fall as amendment 12 and is deserving of thorough support.

Q The universities should be held strictly accountable for the character of the technical training they are providing—but at the same time it is the reciprocal duty of the electrical industry which is so much concerned in this result to see to it that the universities are properly provided with funds. Amendment 12 in California is one step in this direction and one upon which the electrical industry should vote Yes in the coming election.

The forced wartime development of the airplane was so rapid and phenomenal that the world at large has not had time to become accustomed to it as a sane and conservative medium of transportation in everyday life. To the average citizen there is still something desperate and almost melodramatic about aviation, because his mental processes have not had time to dissociate it from the hair-raising adventures of the army and 'stunt fliers.'

The close of the war released large quantities of aviation equipment, and large numbers of trained fliers, and the events of the past two years have paved the way for the peace-time utilization of this material, and for a more normal attitude towards air travel. The forest patrol service, for instance, has done excellent and efficient work during the past season, and in 409,965 miles of flight records only three fatalities, all in one accident. Collected figures go to show that flying, other than stunt flying, has a safety factor which compares favorably with that of any other means of transportation.

The latest and most interesting developments

are in connection with hydroelectric construction work, where the airplane bids fair to be of unparalleled service. Articles in another part of this issue point out the various advantages, which include speed of transportation, emergency work, facilities for mapping and inspecting precipitous regions, and distinctly lowered costs in districts which would entail expensive road-building for hauling by motor truck.

The hydroelectric program of the West makes this subject of particular interest in this section of the country, where the mountainous topography and the inaccessibility of some of the great water sources bring out the special advantages of air service.

It is characteristic also that the West should be foremost in the practical application of the airplane in hydroelectric development, several Western



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companies having made considerable use of airplanes in this connection, both for mapping and inspection purposes, and in the rapid transportation of personnel from headquarters to the scene of construction.

It is hoped that the data presented in this issue of the Journal of Electricity will encourage serious consideration of the commercial possibilities of the airplane, and particularly that it will point the way towards an appreciation of its great possibilities in the field of hydroelectric development.

The entire interest of the nation is today centered upon the West and the wonderful returns

The Increase in Population in the West

on population statistics that are each day being announced by the Census Bureau at Washington. That California shows a population of 3,426,536, or an increase of 44.1 per cent over the 1910 census, is a statement that has caused all eyes to be focused to the West. It means much for industry, and it means much for new business activities in this section of the nation. When we stop to think that at the present time this one commonwealth of the West is growing at the rate of a million people a decade, and that these people are of a very high order of citizenship with a personal wealth far above the average, it is not difficult to see the effect on industry in general and on the electrical industry in particular that this influx will have as the years continue to roll by. While there have been greater increases in percentages during previous decades in statistical census reports, there never has been on record in the West such a gigantic total in population for a ten-year period as this million increase shows in California for the last decade.

If suddenly the supply of all mineral fuel—coal, petroleum and natural gas—should be shut off, is

What If Mineral Fuels Gave Out?

there sufficient potential water-power in the United States to supply the light, heat and power now furnished through the use of these fuels? The answer is, No! The maximum annual production of these mineral fuels in terms of power is approximately 7220×10^9 hp.-hr. This figure is 7,220 billions of horsepower hours, and hereafter in this discussion the unit of billions of horsepower hours will be used, a unit quite familiar since the floating of the Liberty Loans. With no storage, the estimated hydroelectric power available but undeveloped amounts to 50,000,000 hp. or 440 billion hp.-hr. annually; with maximum practical storage, this figure would increase about four times. Consequently, there is just one-sixteenth enough water power undeveloped to take the place of non-reproducing mineral fuels, or, if storage is utilized to the maximum, only one-fourth, when we take into account every possible resource of water-power development in the United States, even though these wonderful resources today are the pride of the nation. Wood as a fuel has not been considered.

Maximum annual production of coal is about 700,000,000 short tons, of petroleum about 400,000,000 barrels, and of natural gas about 700,000,000,000

cu. ft. Taking the conversion factor of coal as 11,000 B.t.u. per pound, as an average, of petroleum as 18,500 B.t.u., with 336 pounds to the barrel, and the heat produced by 7,000 cu. ft. of natural gas as equivalent to that produced by one barrel of petroleum, and one hp.-hr. equivalent to 2,547 B.t.u. per hour, the power developed is easily obtained. For coal it is 6,000 billion hp.-hr., for petroleum 980 billions and for natural gas 240 billions, totaling 7,220 billion hp.-hr. The light, heat and power available from these mineral sources is to the power available from unstored and yet undeveloped water powers as 7,220 is to 440 or as 16 is to 1.

Since there is not enough water by 4 to 1 even under maximum practicable storage, the answer to the problem is the development, as soon as possible, of all the water resources in order to save for the future the stores of non-reproducing mineral fuels, the development of still more efficient methods of getting all the heat out of fuels when fuels must be used, besides the development of some reproducing source of power other than water.

In the installation and operation of steam electric standby plants, oil fired, throughout the West,

Draft Required in Fuel Oil Practice

it is customary to overload boilers up to 150%, 200%, and sometimes as high as 300% of their rated capacity. The actual horsepower may therefore be very different from the installed capacity. In designing the chimney it is essential to know what capacity is expected from the boilers, and to be guided accordingly. In recent months, however, such unusual conditions have been thrust upon steam auxiliary power plants, due to the unusual demand for power, that all constants used formerly in the design of chimney characteristics have become greatly unbalanced, and as a consequence the question of actual draft required for fuel oil burning in the steam electric power plant becomes one of prime consideration. On another page of this issue appears an extended account of research on this matter; here is set forth just how the draft may be computed, and, in instances where required, may be increased by artificial means. In fuel oil practice the question of the draft required is greatly simplified by the fact that the air does not have to be drawn in through a thick bed of fuel, and there are no ashes or clinkers to complicate the matter further. The resistance offered to the entrance of air to the burners is caused by the checkerwork furnace floor, and as the openings in the checkerwork can be altered at will, it is evident that the amount of draft required in the furnace depends largely on the arrangement of checkerwork adopted. The only way that the actual draft conditions can be ascertained for best efficiency in any one particular power plant is of course through actual study of operating conditions in that power plant. However, the general laws that are encountered in steam power plant generation, where oil is used as fuel, have been studied out and definite characteristics found to prevail. In these days of unusual power demand, would it not be well for operating engineers and

executive engineers to look more deeply into this subject, and see to it that the best and most economic situation prevails in the power plants under their direction in regard to this important factor of draft?

Franklin T. Griffith, chairman of the water power development committee of the National Electric Light Association, and newly elected president of the Northwest Electric Light and Power Association, presented some able

Why Not More Local Pride?

thoughts at the recent convention in Spokane of the Northwest Association. But the one thought above all others that stood out was his statement that people of a community should learn to boast about the solvency of the utility company serving that community with that same pride that they boast about the physical service and record in engineering achievement connected with it. This is a vital thing in community spirit, and its resultant helpfulness to the utilities serving that community is of no small proportion. No greater service can be done by men of our industry than to pass on this ideal of promotional helpfulness through the various clubs, organizations, and associations which exist among men of our industry throughout the West, and through which the public may be reached direct.

As long as the Federal Water Power Act has been characterized by Emerson Hough in the Saturday Evening Post as "the latest menace to the national parks," it might be well to consider briefly this phase of the matter.

Water Power Sites in National Parks

Isn't it just possible there is another side to the question than that referred to by the author mentioned above?

The Federal Water Power Act was signed by the President only after Secretary Payne withdrew his objections on the assurance that Senator Jones would introduce into the next Congress an amendment excluding national parks and monuments from the Act. The question now is, might not such an amendment prove detrimental to the best interests of many communities?

If water-power developments are to be excluded from national parks then it seems only just that the boundaries of these parks should be fixed. If, on the other hand, it is permitted to move these boundaries at will, then it does not seem that any hard and fast rule should be applied to water-power sites within these confines.

One case in point illustrates this. If the Sequoia National Park in California is allowed to extend its borders north, as now proposed, and as it now seems Congress at its next session will permit it to do, valuable water-power sites will forever be lost to a community which needs every horsepower available in order to continue its growth. In the Kings River area thereby affected, there is known to be half a million horsepower undeveloped.

In the southern part of California there is now not enough water power available to allow a contin-

ued growth of the country unless certain watersheds within national park boundaries can be utilized, and it is believed that the beauty of certain regions could be added to rather than detracted from by such developments.

Elsewhere in this issue of the Journal of Electricity there appears an account of the ceremonies which accompanied the starting of an electrically operated gold dredge in the world-famous Comstock district of the state of Nevada. The fact that the entire state showed unusual interest in this forward step in the mining industry made possible through the use of electric power, makes the event significant to the electrical industry; but more than this, the dredge is of significance in that it is the only one in existence which can boast of a deck entirely welded by electricity.

This was done at the advice of George L. Hurst of the Bethlehem Shipbuilding Corporation, Ltd., who designed the dredge and even advocated that the entire structure be electrically welded. Now that the practice has proved highly successful in the case of the Nevada dredge, a large one, soon to be constructed in California, is to be entirely welded by electricity. Mr. Hurst estimates that this will mean a saving in cost and in weight of at least 10 per cent.

The 140 by 61 foot deck of the clam shell dredge now being constructed at Pittsburgh, California, is being electrically welded in much the same way as the Nevada dredge, details of which are given in the article mentioned above.

These concrete examples of the extensive practice of electric welding in Nevada and California go to show that the West is taking the lead in a field which offers unlimited opportunity for the use of electricity in industrial construction.

The successful operation of the electric drive equipment in the mine is a subject of great importance throughout the West at the present time, where the economic demand for low cost of production is insistent.

Hunting Troubles in the Mine

According to B. B. Beckett, who on another page of this issue contributes a very interesting article on "Trouble Shooting in Gold and Silver Mines," it has been found that at Goldfield, Nevada, where about one hundred and ten motors were connected, failures averaged four or five per month in motor drive. Slight investigation has in the past been given to this subject of failures in mine drive, hence these data of Mr. Beckett's wherein various discussions of the effect of vibration, dirt in the oil, water on windings, overload conditions, loss of one



THE FIRST RAILROAD was built by Stephenson in 1825, but you needn't cross the continent to get things when

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line connection, and original defects of the motor are discussed, are of great timely importance.

The possibilities of the electric drive in the mine are only at the beginning, and the West with its vast potentialities in mining development presents a promising field for ever increasing uses of electricity in the mines.

Revision of construction rulings is to be expected from time to time and with progress in manufacture and construction methods, it is in some measure justified. The necessity of having these revisions made by a body competent of judging their justice is made apparent, however, by the situation in which the state of Washington now finds itself. The state legislature there some years ago passed an act fixing construction standards for power company property with a retroactive clause making it necessary for the power company to have all its lines and other structures conform with the requirements by 1922. It is obvious that any retroactive clause is pernicious, whatever its time allowance for compliance may be, there being always certain equipment which remains in working condition at the end of the allotted period. In this case it is estimated that from one to two million dollars would be required to conform with the law and a strenuous effort is being made to have it repealed.

That no community is free from the dangers of such an act is shown by the fact that similar legislation based on the Washington example was recently introduced into the Utah legislature and only defeated by prompt action. The utility commission with its organization and opportunity for learning the facts of the situation and of framing a fair-minded judgment is obviously the only body which should be entrusted with such rulings. The public should be made to realize that the power company is not seeking to evade a duty but rather to prevent economic loss which in the end must react upon the consumer himself—another example of the fact that the power company problem is not one between the company and the regulating bodies but rather be-

tween the company and the people itself to whom the utility commissions must justify their actions or be superseded. This suggests another phase to the continual educational campaign which is becoming the vital basis of central station prosperity—the selling of the regulatory commission idea as the best safeguard to community and company alike.

Another world's record has been added to the annals of Western engineering. With equipment designed and built at the plant of the Federal Telegraph Company at Palo Alto, California, wireless messages are being flashed from the new Lafayette station near Bordeaux, France, and caught with perfect regularity across a distance of over six thousand miles by the California station.

The Lafayette radio station, which is equipped with two 1,000-kw. arc radio transmitters, is the largest radio station in existence, both in power and range of the radio set, and in the number and height of towers. The wave length is 23,000 meters, the longest so far employed. The station was placed in active operation on August 21st last, and, after extensive tests had been conducted by communication with the Palo Alto plant, was turned over to the United States Navy Department about the middle of last month.

For the perfection of this record-breaking equipment, credit is due to Western brains and skill; to such men as Leonard Fuller, recently associated with the Federal Telegraph Company, on whom Stanford University conferred the degree of Ph.D. for his research work in this connection; and to R. R. Beal, chief engineer for the company, who supervised the installation and tests at the Lafayette station.

Few advances in modern science have more significance, or more fascination, than this annihilation of distance by wireless communication, and that the West should be responsible for this latest great achievement is one more testimony to the spirit of enterprise and accomplishment which has always characterized the engineering activity of this section of the country.

The New Journal Book Service

WHERE may the lover of good books find timely assistance for the satisfying of his wants, is a question that has so frequently come to the attention of the editorial offices of the Journal of Electricity that we have decided to institute in San Francisco the most complete service of this nature established anywhere in the West. In the offices of the Journal of Electricity are to be found unusual facilities for those interested to find the latest in books that have been published by the McGraw-Hill Book Company, which comprise over eleven hundred titles of the latest and most authoritative works on engineering subjects. The Journal of Electricity hopes to make this service in the West one of far-reaching helpfulness to men of the industry throughout this district. Make known your wants either in person or by mail, and we shall endeavor in every way possible to render the high type of service for which the Journal of Electricity has always stood. Do not only make use of this service yourself, but pass along to your friends throughout the West the information that here they may find the assistance they desire in the matter of the latest in technical, trade, and engineering books.

The Airplane in Modern Hydro-Electric Practice

BY R. C. STARR

(Exact details regarding the resources and characteristics of a drainage area are of vital importance in determining the economic practicability of certain hydroelectric developments. That the data can be most surely and efficiently collected through aerial surveys is proved by actual experience here described by the construction engineer of the San Joaquin Light & Power Corporation. Copyright pictures reproduced here by permission of U. S. Air Service.—The Editor.)

The useful application of the airplane in modern hydroelectric practice is receiving its first real test in America at the present time in connection with the aerial surveys being made by the writer for the San Joaquin Light & Power Corporation in connection with the Kings River hydroelectric project, consisting of eleven plants with a total capacity of 500,000 hp., for the complete development of which a construction program covering a period of ten years is contemplated.

During the late war the airplane proved its usefulness in many ways. Aerial photographs were taken by the thousands, in some areas each day, and close examination and comparison made it possible to determine the location of troops and new batteries. Since the end of the war the army has employed its aviation forces in augmenting the forestry fire patrols and in making aerial surveys of harbors, fortifications, etc. Some of the maps now completed are so accurately made that the location of gun mounts can be determined within a few feet.

Many of the large lumber companies in America have adopted this method of making surveys, especially in Washington, Oregon and Maine, where the ordinary method of surveying and cruising would be extremely expensive, on account of the very dense underbrush in these localities. Data on the density of the timber growth, taken from aerial photographs, is used in the location of saw mills, logging chutes, etc., and enlargements of a part of the photographs enable the lumber man to determine the kind and quality of timber in a certain locality.

As is well known by all engineers, the most important factors in the design of a hydroelectric project are drainage area, precipitation and run-off. These must be accurately determined before the available horsepower and the economic capacity of

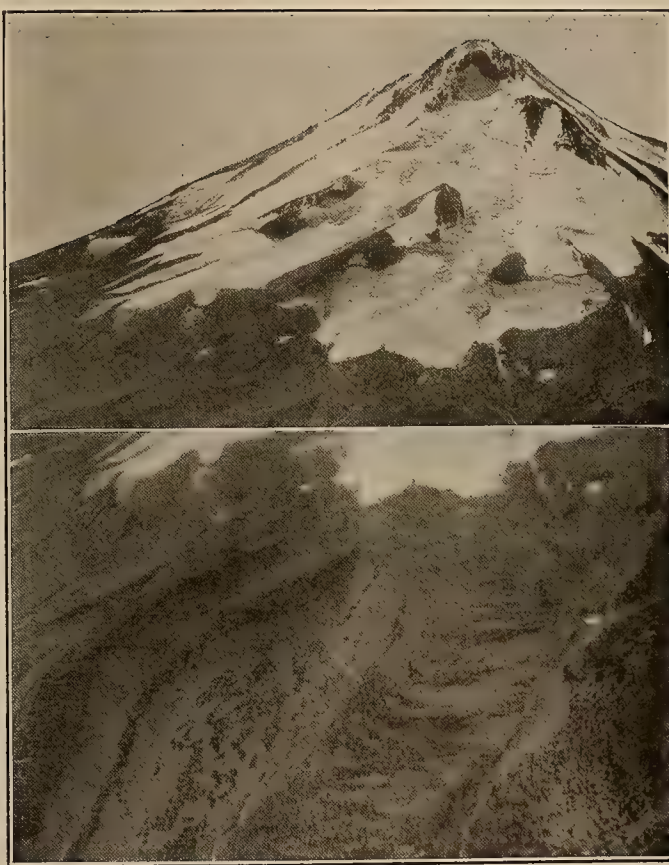
reservoir, conduit and plant, can be determined. There is access, of course, to all records of stream flow for areas similar to those to be studied, but it remains to obtain the accurate drainage areas and their exposure and character before the records of stream flow and precipitation from other watersheds can be used with any degree of accuracy.

It is a well-known fact that the precipitation on

different watersheds of similar character, adjacent to each other, varies to a considerable extent, due to the general direction and velocity of the wind currents, and to other factors such as the average slope of the drainage area, which affects condensation, precipitation and the run-off period. For example, the precipitation on the long flat slope of the Sierra Nevada range east from Sacramento to Lake Tahoe and Truckee increases until an elevation of approximately 6000 ft. is reached; above that there is a decreasing amount of precipitation to the divide. That this condition does not exist, however, on the drainage areas of the San Joaquin River in the San Joaquin Valley is shown by precipitation records at the Kerckhoff plant, Crane Valley and Huntington Lake, on the San Joaquin River; and at Trimmer,

Balch Camp and Lake Wishon, on the North Fork of the Kings River.

Other important factors in run-off are the character of timber growth, amount of smaller vegetation and depth of soil obtaining on a drainage area, and the percentage of total area exposed to the sun's rays. The areas above 11,000 ft. on the Sierra Nevada



The upper picture shows the crest of Mount Shasta, and the lower the slopes where the water runs from under the perpetual snow fields, a typical source of Western water power. The photographs, taken from an airplane at an elevation of 11,000 ft., show the same snow line from different angles.



WIRELESS TELEGRAPHY was invented by Marconi in 1900, but wire is still used for clothes lines. If you have any to sell,

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An airplane picture of Alturas, California. The accurate and detailed view of a wide area obtainable in an air photograph makes the airplane an unequaled medium for collecting topographical data with ease and dispatch.

ranges, not reached by the afternoon sun, always maintain the late summer flow best, and ranges with southern exposures always have early run-offs. A watershed combining these two conditions, as does the Kings River drainage area, provides a long run-off period.

Special Accuracy of Air Survey

To obtain the average per cent of drainage area covered by vegetable growth and timbered area in any other way than by airplane would be very expensive and a mere approximation. A mosaic map made from aerial photographs will show in detail the exact amount of a drainage area covered by timber growth.

In studying large projects, such as the Kings River project of the San Joaquin Light & Power Corporation, the proposed developments of the Southern California Edison Company on the San Joaquin River, and other projects, field surveys must of course first be made to check the government quadrangles as to the accuracy of the elevations in the beds of the streams. It is a well-known fact that while the government quadrangles are a very good guide, elevations, especially in the bottom of streams, are not exact. The United States Geological Survey, in making the quadrangles, obtains accurate elevations at triangulation points, and uses stadia in obtaining stream elevations, etc.

On account of the length of time which would be required to make completely accurate surveys and topographical maps of sections covered by a quadrangle, drainage areas and contours shown are only more or less accurate.

Studying Details of a Drainage Area

The most important part of the drainage area is that near the summit, especially on account of the fact that at this point in the Sierra Nevada range are to be found many small glacial lakes. With especial reference to the North Fork of the Kings River drainage area, where a field reconnaissance has recently been made, there are to be found dozens of

such lakes at elevations from 10,000 to 12,000 ft., where very cheap storage reservoirs can be made by driving tunnels or making open cuts through the granite barrier forming the rim of the lakes, and building dams 10 ft. to 20 ft. in height at such points. These reservoirs can be developed for from \$10.00 to \$25.00 per acre-foot.

The most economical capacity for which these reservoirs should be developed is absolutely dependent upon the drainage area, and the only method by which this drainage area can be accurately and economically surveyed is by the "aerial picture" method, as it would be impractical to attempt a ground survey on account of the enormous expense. The use of the airplane also prevents the possibility of some mountain reservoir sites being overlooked on account of their distance from any trail and the time required to cover the entire drainage area on foot and horseback.

For the foregoing reasons the writer has recently devoted considerable time to the study of methods employed by the War Department in France and in this country in making aerial surveys of fortifications and other government projects.

Aerial Surveys of Kerckhoff and Kings River Projects

As a preliminary test of the methods employed by the government, an aerial survey was made of the Kerckhoff project on September 25. The aerial survey was entirely successful and checked favorably with actual ground surveys, and a similar survey of the entire Kings River projects, including a drainage area of 200 square miles, is being completed at the present time. The base of these surveys is Forkner Field, Fresno. A Varney Lincoln-Standard plane with a 150-hp. Hispano-Suiza motor belonging to the writer is being used. A special aerial camera belonging to the War Department, known as the G. E. M., manufactured by the Eastman Kodak Company, mounted on a special tripod in the cockpit, is being used for the photographs. Lieut. F. T. Honsinger, of the Ninth Corps Area Air Service, is piloting the

plane, and R. L. Bryant, assistant engineer, construction department, San Joaquin Light & Power Corporation, is official photographer. Mr. Bryant had charge of the original field triangulation surveys of this project, reporting to Wm. H. Becker, resident engineer on the Kings River project.

On account of the high elevations from which these photographs are being taken, special high gravity aviation gas is being used.

Major H. H. Arnold, in charge of the Air Service, Ninth Corps Area, with headquarters at San Francisco, also Captain A. D. Smith, Lieut. H. A. Halverson, Lieut. J. R. Morgan, Lieut. Miller and Sgt. Russell, all of the Air Service, have been of great assistance to the writer in connection with the study of this problem and in connection with the aerial surveys which have been made by the San Joaquin Light & Power Corporation.

Methods Employed in Making Air Surveys

Before an air survey of a drainage area is made it is necessary to lay out the aerial work to be done on a map of the area to be surveyed. All flying is done by compass and from certain fixed points, the distances between which are determined by the elevation from which the photographs are to be taken, so that photographs will lap slightly on all sides. A certain amount of field work must first be done in establishing triangulation points, which can be picked up from the air. These serve as a basis for laying out the "mosaic," which is made by piecing together the photographs taken from the air.

It is readily seen that in order to obtain an exact scale map by aerial photography it is necessary to fly different sections at different heights. For this reason, the area to be photographed is divided into sections, and areas from 1,000 to 5,000 ft. in height are flown at a height of 10,000 ft.; sections from 5,000 to 8,000 ft. in height are flown at 13,000 ft.; sections from 8,000 to 10,000 ft. are flown from a height of 15,000 ft., etc.

In taking the photographs the first thing to be established is a base from which to fly a given area. The elevations at which photographs are taken are recorded by altimeters located in the plane. Levels are used on the camera to see that it is taking the photographs in a vertical plane, and a drift set is used to determine the amount of drift, so that the camera can be set at a slight angle with the plane, to allow for the drift of the plane during the flight.

Aerial photography requires the services of two men—pilot and photographer, and it is very essential that communication between the two be possible at all times. This is accomplished by the use of a small tube connecting the two. It is necessary for the pilot to level his plane whenever the camera man is taking a picture.

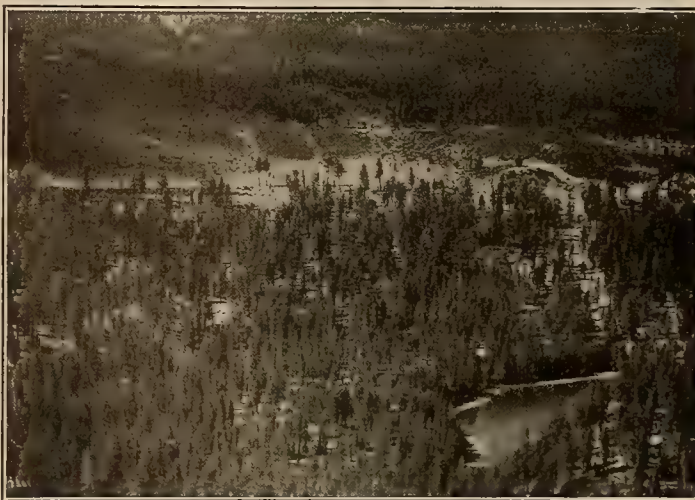
The work which requires most time is the development, enlarging and fitting together of the various prints, as it is necessary to enlarge some photographs to fit others, so that they may all be made on the same scale. The great value of such a map when completed lies in the accuracy with which all prominent features can be picked out, and the fact

that any portion of the map can be enlarged to any scale to obtain detail.

After the map is made, by comparing the same with the quadrangle elevations, contours can be sketched with great accuracy, and the actual lengths of proposed schemes for tunnels, conduits, etc., can be obtained with much greater accuracy than in any other way, without making complete ground surveys. Preliminary studies of possible schemes of development can then be made before complete ground surveys are made from the preliminary layout on paper location.

Aerial Railroad Surveys

The same general scheme can be followed in making a reconnaissance and preliminary paper loca-



Airplane view on Fleming Creek, elevation 9,800 ft., showing one of the many mountain lakes in this country and the typical drainage area. Fleming Creek is a tributary of the North Fork of Kings River, and its development forms part of the great 500,000-hp. project of the San Joaquin Light & Power Corporation, in connection with which the airplane has already been used to a considerable extent.

tion for a proposed railroad or highway. Thousands of dollars are spent usually in determining the best and cheapest route, and a locating engineer always feels that perhaps somewhere there is a pass which he knows nothing of, as hours and hours of walking and horseback riding are necessary to reach every possible location. A preliminary reconnaissance by airplane, and later aerial photographs and studies of the government quadrangles where obtainable, make an error of this kind almost impossible, and the writer believes future railroad preliminary surveys will largely be made by airplane.

The writer wishes at this time to thank the management of the San Joaquin Light & Power Corporation for their support in undertaking the "aerial" method of mountain surveys, as it always requires courage to be the first to put theory into practice. The results obtained, however, have proven beyond doubt the value of these surveys for preliminary studies of large hydroelectric projects.



TELEPHONES were invented by Bell in 1876. Don't swear when the number you called 'does not answer':

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In the inspection of drainage areas, the investigation of snowfall conditions, the mapping of precipitous regions, and the speedy transportation of men and supplies, the airplane bids fair to become an important factor in hydroelectric development in the West. This view, reproduced by courtesy of the Photographic Section of the U. S. Air Service, shows the upper drainage on the west fork of Kings River.

Airplane Costs in Hydro-Electric Work

BY ERNEST W. DICHMAN

(Economies in hydroelectric construction work will mean much to the West in carrying out its tremendous power program of the next ten years. That the use of airplanes in this work can be not a visionary impossibility, but a practical business venture, in safety, reliability, speed and lowered costs, is brought out in the following article by the chief of Structures and Aerodynamics Branch of the Engineering Division of the U. S. Air Service.—The Editor.)

In 1909 when Orville and Wilbur Wright first made a successful attempt at flight in a heavier than air machine, the airplane was looked upon as an interesting invention and few people beyond the most visionary predicted that it would serve any useful purpose or even be more than a mere curiosity.

Under circumstances such as these it is not surprising that the development of the airplane progressed rather slowly until the beginning of the war in 1914. Not long after the commencement of hostilities the airplane proved its value as an aid to military operations; first for purposes of scouting and artillery observation, later for bombing, and finally in the development of the single-seater fighter as a combatant arm of the service.

The rapid development of the airplane produced a wealth of technical information unparalleled in the history of any science, and it can be said without exaggeration that during the war the science of aeronautics made a stride equivalent to fifty years of peace time development.

Consideration of Commercial Possibilities

The post-war period, while not furnishing so great a stimulus to airplane development as war conditions made possible, permitted the airplane to develop in a firmer and more stable manner. Quite naturally its commercial possibilities were considered, and as a result we have the London-to-Paris aerial transport service, the aerial mail, and a large number of smaller transportation projects. The peace time uses to which airplanes may be put are many and varied, but in any event, whether they be used for transportation of people or materials, for

advertising, mapping, photography, forest patrol, or merely for pleasure and sport, the problem in its final analysis is one of costs in proportion to service rendered,—initial cost and costs of operation and maintenance. In order to prove itself a sound investment any plan for the use of airplanes must earn a substantial income or else perform some function more efficiently and economically than existing methods permit.

Adaptability of Airplanes to Mountain Construction Work

A plan for the use of airplanes which should be of particular interest to engineers of the Pacific Coast generally is its employment as a carrier of men and material in connection with construction work in the mountains. This applies equally well to mines, hydroelectric developments, or the construction of water supply systems. Often the construction camp is but a few miles distant from the nearest railroad station, yet because of the character of the terrain the haul is a long and consequently expensive one. The airplane can here be used to transport men and material, often eliminating the necessity for building a road; or used as an adjunct to motor haul, may keep the construction camp supplied during seasons when roads are impassable. The airplane is also exceptionally well adapted to the rapid transport of officials from the main office, or of small but vital pieces of machinery from the factory in cases of emergency to any power house, substation, or construction camp. The distances in such cases often run into hundreds of miles, and the time consumed in transit would be reduced from days to hours.

Factors in the Success of Aerial Transportation

Let us first examine the necessary characteristics for a successful aerial transport system. Listed in order of their importance they are as follows:

- I. Safety
- II. Reliability
- III. Speed
- IV. Costs in proportion to service rendered.

I. Safety in Flight —

In time of peace safety in flight is undoubtedly the most important consideration. No one would be justified in taking unwarranted risks with human life to secure greater speed or lower costs of operation. Unfortunately there exists in the mind of the uninitiated a firm impression that flying is a very hazardous occupation and for that reason many people are timid about making a flight. In this connection an article quoted below from the Boston Transcript of December 11, 1919, serves to refute the popular impression on the danger of flying as a commercial proposition.

"British Register 21,000 Aerial Trips in Six Months with Only Two Fatal Accidents. None of 52,000 Passengers Killed.

"London, December 11.—Statistics of the safety of civil aviation are given in a synopsis published by the Air Ministry of progress between May 1 and Oct. 31. The figures (approximate only) are as follows:

Number of flights.....	21,000
Number of passengers.....	52,000
Mileage	303,000
Accidents	13
Fatal accidents	2

"Both the fatal accidents happened to pilots. Six pilots and ten passengers were injured, or one passenger injured for every 5,200 carried."

Statistics on file with the Air Service show that less than 5 per cent of all accidents which do occur are due to defects of the airplane structure, and the remaining over 95 per cent of accidents are due to the pilot's carelessness or poor judgment. Safety in flight is really measured by the pilot's ability, and a careless pilot, as a careless chauffeur or locomotive engineer, can endanger the lives of his passengers. It will not be possible to digress in order to explain what constitutes a first-class pilot. Sufficient to state that it requires a long training combined with natural common sense, and a lack of any desire to play the fool. During the war a great number of excellent pilots were produced.

II. Reliability —

Reliability of a service such as proposed would be measured by its ability to run on scheduled time in spite of severe weather or other causes for delay. The most important factors contributing to the reliability of an aerial transport service are the ability of the engineering force properly to maintain the airplanes and engines and keep them in perfect condition; the kind of weather encountered in the territory to be served, and the ability of the pilot to use his engines as advantageously as possible and not to abuse them.

An indication of the extent to which airplane operation can be relied upon may be obtained from the records of the aerial mail service between New York and Washington for the fiscal year July 1, 1918, to July 1, 1919, given below:

Total number of trips possible.....	1,435
Total number of trips attempted.....	1,387
Number of trips defaulted.....	47
Number of trips in fog.....	511
Number of trips in clear.....	918
Total number of miles traveled.....	160,066
Per cent of performance.....	93.81%
Number of forced landings due to motor trouble.....	36
Number of forced landings due to weather.....	33

A per cent of performance varying from 83% in the winter months to 95% in the spring and 99% in the summer and fall, giving an average of 94% for the year, is a very encouraging figure. Especially so as the climate along the Atlantic coast is very severe with extensive ranges of temperature for summer and winter. With mild winters such as are common in California it is certain that the figure of 80% for the winter months would be considerably bettered.

III. Speed —

Speed of course is the big advantage of aerial transport. In addition to a flying speed of from 100 to 125 miles per hour characteristic of our latest machines, it is possible to steer a direct course for the objective instead of having to take a circuitous route and follow the contour of the terrain as in the case of railway or automobile. This last point is an important one in the consideration of the use of the airplane as an aid to hydro-electric construction. To illustrate let us say, for example, that the camp is twenty miles distant from the nearest railroad by air line and at an increase of elevation of 4,000 feet. Assume the haul by road is forty miles, which being twice the air line distance is a fair estimation. Under circumstances such as these a motor truck would make the round trip in two days, while mules would require at least four days for the round trip. For an airplane with a speed of 90 miles per hour, one hour would be sufficient time for the round trip and include one-half an hour for loading and unloading. On the assumption of an eight-hour day this means that the airplane is sixteen times as fast as motor trucks and thirty-two times as fast as mules.

IV. Costs in Proportion to Service Rendered —

Let us now turn our attention to the important subject of the cost of such a system. Of course, no detailed statement of costs can be made until we know the particular conditions under which such an aerial transport system is to operate. These particular conditions are listed below:

1. The length of the air haul which would be equivalent to the air line distance between the two points.
2. The difference in elevation between the two points.
3. Approximately the total amount of material to be hauled, and the character of this material—namely, bulky or compact.
4. The availability of landing fields at both station and camp, and the character of the intervening country.
5. The weather conditions encountered in the territory to be served.



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Upon a study of the above conditions the following points can be tentatively decided:

1. The size and type of airplanes.
2. The number of airplanes.
3. The number of trips per day and the schedules.
4. The load to be carried per trip.

Costs may then be divided into initial cost, maintenance cost, and depreciation.

Initial costs include:

1. Purchase of airplanes.
2. Preparation of landing fields.
3. Erection of hangars and machine shops.

Maintenance costs include:

1. Maintenance of airplanes.
2. Maintenance of landing fields.
3. Maintenance of hangars and machine shops.
4. Salaries of pilots and mechanics.

Depreciation includes:

1. Depreciation of airplanes.
2. Depreciation of hangars and machine shops.

A study of the above costs for any particular set of conditions permits us to predict with considerable accuracy the cost per ton and hence the cost per ton mile of transporting material from railroad to camp.

Referring to our previous example, where a twenty-mile air haul was equivalent to a forty-mile road haul, it was shown that an airplane was sixteen times as fast as a motor truck and thirty-two times as fast as mules. This means that an airplane capable of carrying 3000 pounds load could take the place of five 5-ton trucks or of sixteen 3-ton wagons each drawn by four mules. Allowing one pilot for each airplane each pilot would take the place of five chauffeurs or sixteen teamsters.

The cost of constructing and maintaining a road from station to camp is an exceedingly large item. With aerial transportation in place of this expense there would be the preparation of two landing fields which often would not require a day's work to be suitable for their purpose.

In order that the economies to be effected by employing aerial transport may be definitely brought out, a direct comparison has been made between the costs of hauling by motor in connection with construction work in the mountains and these same costs had aerial transport been employed.

Costs of Motor Transportation

In 1917 the cost of motor hauling on mountain roads ran about 35 cents per ton mile, exclusive of the cost of road construction and maintenance, so that it is safe to assume that present day costs would be approximately 50 cents per ton mile. The cost of mountain road construction is about \$15,000 per mile and maintenance \$500 per mile per year.

Now let us apply these figures in the case of a construction project in which the following conditions exist:

The air line distance between the nearest railroad and the construction camp is 20 miles.

The construction camp is at an elevation of 4,000 feet above the railroad.

The road connecting railroad and camp is 40 miles.

The project is the construction of a dam, so the material to be transported would be mostly cement.

The total amount of material to be transported is 15,000 tons.

The duration of the job will be approximately two years.

The ground at the reservoir site will have to be cleared anyway, so the expense of a landing field at this end need not be charged to the aerial transport.

The landing field at the station could be prepared for less than \$1,000.

The weather in the winter is rainy, rendering the roads impassable for three months.

The cost of hauling by motor would be as follows:

Road construction, 40 miles @ \$15,000 per mile.....	\$600,000
Road maintenance, 2 years, 40 miles @ \$500 per mile per year	40,000
Total cost of road over two years.....	\$640,000
Direct operating costs of hauling 15,000 tons over 40 miles @ 50c. per ton mile.....	300,000
Total cost of hauling, including cost of road.....	940,000

NOTE.—The depreciation and repair of trucks, and salaries for chauffeurs and mechanics are all included in the figure of 50c. per ton mile.

The road would of course have no salvage value so that no rebate could be obtained from that source, and therefore the net cost of hauling 15,000 tons of material in two years by motor from the railroad to the construction camp, 20 miles distant by air line and at an increase of elevation of 4,000 feet, entailing a road haul of 40 miles, is \$940,000.00, or \$1.57 per ton mile.

Let us now investigate the cost of hauling this material by airplane.

Aerial Transport Service Cost Data

For this service we should use two bi-motored airplanes patterned after the bombing airplanes in use during the recent war, but modified by using a high lift rather than high speed wing section, and possibly slightly increasing the area of the wings so that each machine would be capable of carrying 3,000 pounds of useful load.

The power plant of each machine would consist of two Liberty 12 engines each delivering 400 hp. at 1700 r.p.m., but ordinarily operated throttled to 310 hp. and 1600 r.p.m. The average speed under these latter conditions will be 90 miles per hour.

Fuel capacity can be limited to one hour as the round trip can be accomplished in less than half that time. Airplanes will be fueled after each round trip.

Each airplane will make 8 round trips a day. As the air haul is only 20 miles this will allow one 1/2-hour per trip for loading and unloading.

Each airplane will then be actually in the air less than 4 hours per day so that during one year of 313 days it will have flown 1,252 hours, after which it will be salvaged for 25% of its initial cost. This figure is purposely placed extremely low, as to keep each machine in the air 1,252 hours will require 20% of the original cost expended in replacement parts.

During one year's operation two sets of engines will be used and salvaged. The total running life of each engine will then be 626 hours. The salvage value of each engine will be 50%. During the life of each engine it will be completely overhauled six times and at each overhauling 10% of its original cost will be expended in replacement parts.

A Liberty 12 engine consumes approximately 26 gallons of gasoline per hour when delivering 310 hp. at 1600 r.p.m., so that two bi-motored airplanes actually in the air four hours each day will consume

during a year of 313 days 130,208 gallons of gasoline. Allowing approximately 20,000 gallons per year for taxiing, testing spare motors and wastage, the total gasoline consumption will be 150,000 gallons per year.

Oil consumption is less than one gallon per engine per hour, so that the total oil consumption would be 5,000 gallons per year.

A hangar and machine shop for the care of the air planes will be erected at the railroad landing field only. This need be nothing more than a board and batten building where the initial cost is low but the salvage value is only 20% of the original cost.

Three pilots will be sufficient to supply the necessary reserve in case of illness or relief in order to operate 10 or even 12 hours per day in case of emergency.

Total amount of material transported: As each airplane carries a load of 3,000 pounds 8 times daily, the total amount of material hauled would be—

2 airplanes 8 trips each, 3,000 lb. per trip, or 24 tons per day.

Working 313 days per year the yearly haul would be 7,500 tons, and in a two-year period 15,000 tons of material will have been delivered.

CAPITAL INVESTED AND EXPENSES

Property Investment:

Preparation of landing fields.....	\$ 1,000
Hangar and repair shop (for two airplanes).....	12,000
Machine tool and hangar equipment.....	8,000
Office equipment	500
Gasoline tank equipment.....	3,000
Total property investment.....	\$24,500

Transportation Equipment Per Year:

2 airplanes @ \$40,000 each.....	\$ 80,000
8 engines @ \$4,000 each.....	32,000
Airplane spares, 20% of airplanes.....	16,000
Engine spares, 60% of engines.....	19,200
Material	10,000

Total transportation equipment, per year.....	\$157,200
Over two-year period.....	\$214,400

Direct Operating Costs Per Year:

Gasoline, 150,000 gals. @ 30c. per gal.....	\$ 45,000
Oil, 5,000 gals. @ 75c. per gal.....	3,750
Total annual fuel cost.....	\$ 48,750
Over two-year period	\$ 97,500

ANNUAL SALARIES FOR PERSONNEL

1 Superintendent of transportation.....	\$ 6,000
3 Pilots at \$5,000 each.....	15,000
1 Shop foreman	4,000
2 Rigger mechanics at \$2400 each.....	4,800
2 Rigger's helpers at \$1800 each.....	3,600
3 Engine mechanics at \$2400 each.....	7,200
4 Mechanic's helpers at \$1800 each.....	7,200
2 Machinists at \$2400 each.....	4,800
2 Machinist's helpers at \$1800 each.....	3,600
1 Clerk and stenographer.....	1,800
Total annual pay roll.....	\$58,000
Over two-year period	\$116,000

OVERHEAD

Rent and upkeep of landing field.....	\$ 1,200
Upkeep of buildings	1,800
Heat, light and power.....	1,200
Insurance on buildings and equipment.....	600
Office supplies	600
Total annual overhead.....	\$5,400
Over two-year period	\$10,800

NOTE—Depreciation considered in determining salvage value.

ANNUAL COST OF OPERATION

Transportation equipment	\$157,200
Gas and oil	48,750
Salaries	58,000
Overhead	5,400
Reserve for unforeseen expenses.....	10,000
Annual operating expense.....	\$279,350
Over two-year period	\$558,700

INITIAL INVESTMENT REQUIRED

Property investment	\$ 24,500
Transportation equipment	157,200
Monthly working capital: Fuel and oil (approx.).....	4,100
Salaries (approx.).....	5,000
Overhead (approx.).....	5,000
Total initial investment	\$195,800

SALVAGE VALUES

Hangar and machine shop, 20%.....	\$ 2,400
Machine, tool and hangar equipment, 50%.....	4,000
Office equipment, 60%.....	300
4 airplanes, 25%	40,000
16 engines, 50%	32,000
Total salvage value	\$78,700

NET COST OF OPERATION OVER TWO YEARS

Property investment	\$ 24,500
Operating expense for two years.....	558,700
Total cost of operation for two years.....	\$583,200
Salvage values of buildings and equipment.....	78,700

Net cost of operation for two years..... \$504,500

It is therefore seen that the cost of transporting 15,000 tons of material by airplane from railroad to construction camp 20 miles distant by air line is approximately \$505,000. This represents a saving of \$435,000 over the cost of performing the same task by motor truck, or a saving of \$29.00 per ton in transporting the material from railroad to construction camp. The comparative figures are tabulated below:

Cost of transporting 15,000 tons of material 40 miles by motor.....	\$940,000.00
Cost of transporting 15,000 tons of material 20 miles by air.....	505,000.00
Saving due to use of aerial transport.....	\$435,000.00
Cost of transporting one ton of material from railroad to camp by motor.....	\$62.70
Cost of transporting one ton of material from railroad to camp by air.....	33.70
Saving per ton due to use of aerial transport	\$29.00

In addition to the saving in cost indicated the airplane has the advantage of being able to operate during those seasons when the roads are impassable, keeping the camp supplied with material and allowing the construction to proceed. Of course there are certain limitations to aerial transport, but only a study of the conditions in each particular case can determine whether or not the airplane can advantageously be used. Unfortunately, so much has been written about the airplane in a spectacular vein that this phase of the subject has in the past overshadowed its more useful purposes. However, the time has come for engineers to realize that the safe and sane development of the airplane is due to make it an important economic factor in our daily life, whose points of superiority may be taken advantage of by anyone having the initiative, energy and courage to do so.



FIRE ENGINES were invented by Van der Heide in 1518. If you want one as a tenant for your new garage,

THE SEARCHLIGHT SECTION
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Commercial Possibilities of Aircraft in the West

BY MAJOR H. H. ARNOLD

(The commercial feasibility of aerial transportation is a logical sequel to the successful use of the airplane in such enterprises as the mail service, the forest patrol, and the mapping of mountainous country by power companies. The author of the following interesting article on the subject is officer in charge of Air Service, Ninth Corps Area, U. S. War Department.—The Editor.)

The considerations which determine the possibilities of utilizing aircraft for commercial purposes are: (1st) The work which can be done by aircraft more efficiently; and (2nd) The availability of suitable airplanes for commercial purposes.

In dealing with the work which ordinarily would be expected to be done by aircraft only so much will



Power sites and drainage areas are usually located in such isolated or inaccessible regions that their mapping or inspection requires large parties and months of work. Two Western power companies are already using airplanes successfully in this work, with great savings in time, labor and expense. The above view was taken from a patrol airplane above the Cascade Mountains in Oregon.

be taken into consideration as has already been attempted in the past by this means of transportation. Such uses of aircraft as exhibition flights and hazardous jitney service for passengers looking for thrills will be omitted as they are probably the best known examples of the inefficient use of aircraft.

Requirements For Landing Fields

Before aircraft of any character can be used efficiently and generally in any locality, landing fields must be provided. These landing fields must be of such a size as to permit the safe landing of all types of aircraft. The size of these fields depends directly upon the speed of the ship which is landing and the elevation of the field above sea-level. At the present time the majority of airplanes utilized have a landing speed of between forty-five and sixty-five miles an hour. This necessitates a field having a perfectly clear run-way in the direction of the prevailing wind of not less than twenty-five hundred feet. These twenty-five hundred feet should be clear of all obstacles over four or five feet high at both ends for a distance of not less than a quarter of a mile. As the elevation of the field above sea level increases the length of the field increases in direct proportion until at an altitude of about seven thousand feet a runway of at least thirty-five hundred feet is most desirable. The great tendency at this time is toward slower landing speeds for airplanes. With the slower landing speeds will come naturally the possibilities of

smaller landing fields. However, this is a subject for the future and not for the present.

Traffic Regulation

In the development of the automobile it soon became apparent to all concerned that in order to safeguard the lives not only of the drivers of the automobiles but also the pedestrians and innocent by-standers along the roads it was necessary to provide laws concerning the use and abuse of automobiles. It is true that local conditions in many cases dictate the laws for certain localities, but there are certain general principles and certain signals which should be applied uniformly to all automobilists in all states.

In the use of aircraft at the present time laws governing the use of airplanes and the qualifications of the pilots are conspicuous by their absence. In a few instances certain cities have taken upon themselves to pass city ordinances, such as City Ordinance No. 620 of the new series of the City of Los Angeles; but this is the exception which proves the rule. It is obvious to everybody who thinks at all on this subject that without laws and regulations governing the use of airplanes in any locality the number of accidents will increase in direct proportion to the number of airplanes in use. It is therefore absolutely essential that with a good landing field which is being used in any locality a set of rules and regulations must be adopted for that landing field.

In order, however, that there should be uniformity in these rules and regulations it is believed to be most desirable that they be based on the general principles adopted by the Inter-allied Aviation Committee which recently met abroad. The principles cover the following subjects:

- (1) When and under what conditions trick flying is permitted;
- (2) Heights above cities at which flying is permitted in order not to be dangerous to public safety;
- (3) Local register and national marks carried by airplanes;
- (4) Rules concerning lights on aircraft;
- (5) Action of a plane in coming into a strange field before landing in daylight and after dark;
- (6) Right-of-way between heavier-than-air and lighter-than-air craft.

Safety Statistics

Commercial aviation at the present time is in its infancy. In England war restrictions on commercial flying were removed on May 1, 1919, and from that date to January 21, 1920, there were 36,000 flights made by civilian aircraft, during which time 66,000 passengers were carried over a total mileage of 619,000 miles. The total casualties during this period were four pilots, one passenger and one innocent by-stander. In the London-Paris passenger service for the year ending August 25, out of 1,635

flights scheduled 1,444 were actually completed. Only six were canceled due to mechanical defects of the airplanes and engines, and out of 1,474 starts made there were only thirty forced landings. This service, according to actual figures, was 94% efficient as far as trips made was concerned. A distance of 323,000 miles was flown by that service during the past year. In the Postoffice Department, Aerial Mail Service, in the United States during the past year 405,000 miles were flown with a total of three deaths.

Successful Commercial Ventures

In Germany a successful commercial line is being operated between Berlin and Frederickshafen. By the use of directional radio it has been possible for this line to operate daily regardless of fog and low clouds which ordinarily are a menace to all aviators.

In the United States little, if anything, has been done toward establishing aerial commercial routes which run with the regularity that is demanded of other forms of transportation. There have been many reasons for this. Among the most important of them are the almost universal feeling that travel by aircraft is not safe and cannot give regular service; the difficulties encountered in aerial transportation in stormy weather; the inadaptability for commercial uses of present type machines which were designed for war purposes, and the great tendency upon the part of most of the pilots now in commercial aviation to capitalize the desire of many people to get thrills. An additional reason is that no firm in the United States up to the present time has put sufficient money into commercial aviation to make it possible to organize a first-class modern, up-to-date commercial transportation company. However, as the horse and wagon gave way to the automobile, so, in time, the automobile will give way to aircraft for certain classes of transportation.

The Forest Patrol

It has been found from actual experience that by means of the airplane a more efficient and complete inspection and observation can be made over large timbered areas than is possible any other way. This is true to such an extent that the aerial forest patrol has come to stay. As an example of what this patrol has done during the past season up to and including September 15, 1920, the following summary of operations is quoted:

Total number of patrols made.....	1,088
Total number of miles flown.....	409,965
Total flying time	3,509½ hrs.
Total number fires discovered	1,456

During that time there were only thirty-seven forced landings, and connected with only one forced landing were there any fatalities.

Mapping Isolated Areas

Closely allied with forest patrol is another important use of aircraft—that of making aerial mosaics of isolated areas and areas for which at the present time there are no satisfactory maps available. This use of aircraft is a natural development from the mosaics which were made during the war of areas behind the enemy's lines.

In order to prove the practicability of this method of securing data from sections of the country of which little is known, the Great Western Power Company is at the writing of this article utilizing an airplane to make a map of its dam site, power plant and power line at Almanor Lake, California. In the same way the San Joaquin Light & Power Corporation has purchased an airplane and is making a mosaic map covering the entire Kings River drainage area. This country is so isolated that in order to secure the same amount of information from any other source months of work by several mapping parties would be required. However, by the use of the airplane the entire area can be covered by photographs in about six hours flying time.

The State Forester of Oregon and the United States District Forester of the Sixth District are at this time considering the possibilities of utilizing the airplane to secure accurate maps of the timbered area of the entire state of Oregon. One of the most serious obstacles in fighting fire which is encountered in Oregon at this time is the lack of suitable maps of the timbered area. This hinders action not only by causing fires to be reported in the wrong locality but also by not affording the fire fighting crew sufficient information to go direct to the fire in order to start operations.

The Field For Aerial Transportation

When it is universally known that commercial airplanes leave Portland, Oregon, at six o'clock every morning and land in San Francisco at noon of the same day, and that this service is run regardless of fogs in the Willamette Valley in the north and San Francisco Bay in the south, there will be no lack of business for the commercial firms which have an aerial line between those two points. In the same way when the power and light companies and private timber owners, railroad lines and construction engineers know that airplanes are available with camera attachments which make it possible for them to secure within a few hours information concerning isolated sections of the country, which by present methods would require the services of several surveying parties for two or three months, there will be ample business for such commercial aviation companies as are doing this class of work.

The airplanes and accessories are available at this time. There are plenty of pilots who are only too willing to engage in this class of work, but the confidence of the public in the ability of the airplane successfully to accomplish its missions, and the lack of public knowledge as to the possibilities of the airplane, are the principal drawbacks which have to be eliminated before commercial aviation can be made an unqualified success.



PIANOS were invented by Schroeter in 1717.
You can compete with your neighbor's
daughter with an electric piano.

THE SEARCHLIGHT SECTION
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Airplanes and Forest Fires

BY PAUL G. REDINGTON

(As a demonstration of the practical civil value of the airplane, the effective work of the Airplane Forest Patrol of the past year is of the greatest interest to industries which are seriously considering the question of business air service. The following article on the subject is by the District Forester of the California District.—The Editor.)



The airplane proved its worth not only in detection but in quick transportation of trained men to the scene of action.

THE success of forestry in the Western United States hinges largely upon the protection of the timber resources from fire. The National Forests in California alone have over one thousand fires per year during the months of July, August and September. The essence of effective fire protection is prompt detection and quickness of dispatch and attack in suppression. The present lookout system, developed during the past twelve years within the National Forests, suffices to cope with the situation under normal conditions. The airplane

does not in any sense supplant this principal method of detection, but merely supplements and augments its operation.

Limitations of Lookout Stations

The primary lookouts, located as they are on commanding eminences within the forest areas, have a general view of their field for twenty-four hours of the day. They have, however, inherent difficulties to meet, such as the topographic nature of the area, permitting only a limited direct visibility; and secondly, temporary adverse atmospheric conditions, which sometimes preclude the possibility of any detection. Under such conditions it is that the airplane can serve its function as a valuable supplemental agency.

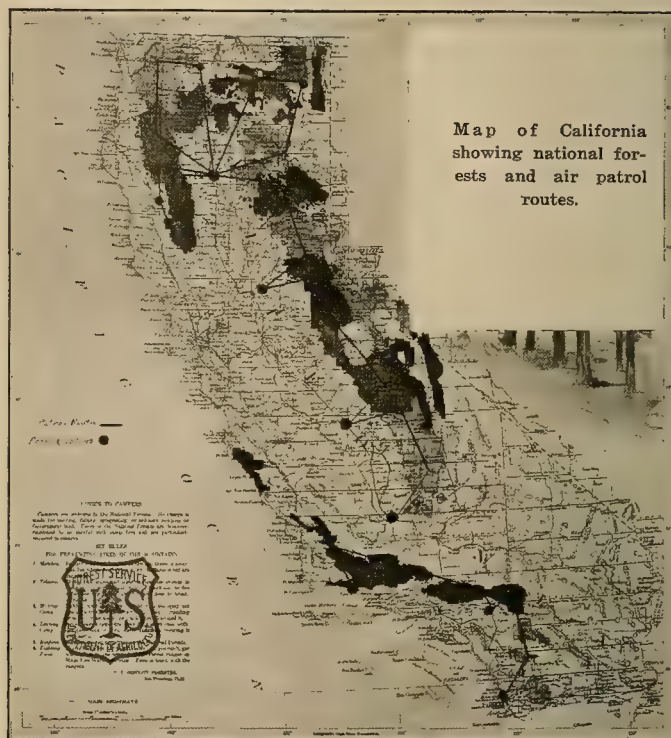
The usual primary lookout, serving an area of 200,000 acres, may have a direct view of only a small portion of this total, in which he can detect a fire from its very inception. He may be able to detect, on other portions of the area, fires when they have reached a moderate size of one to five acres. There are, however, still other portions, particularly in the deep canyons, from which smoke can only be seen when it comes from a fire having reached a point of extreme potential danger.

Special Advantages of Airplanes

The airplane flying at an average altitude of 10 to 11 thousand feet through the California forests has before it like an open book, canyon and hillside, dense timber and open meadow. No matter how small the fire, a keen observer can note its full character without difficulty. This year a few fires were reported by the airplane which proved to be nothing but extra large camp fires. It was essential to train the observers to recognize the character of the smoke of a small uncontrolled fire.

It frequently happens that a haze covers portions of the National Forests during certain hours of the day when lookouts at the elevations can give no effective detection. The airplane observer, on the other hand, flying at higher altitudes can see through the moderate haze with sufficient accuracy to serve the purposes of quick detection. This is due entirely to the difference of the angles of incidence of the sunlight from the point of view of the airplane observer and the lookout. The same holds true for certain conditions produced by the smoke mantle from a large fire.

In these ways the airplane serves as a supplemental detection agency, where primary lookouts are unable to function fully. It must be pointed out, however, that during the pre-fire season when only



The success of the forest air patrol has paved the way for the development of civil aviation. In the above map are shown the California forests and the air patrol routes with the main bases and sub-bases. The forest patrol flew 409,965 miles this season and discovered 1,456 fires.

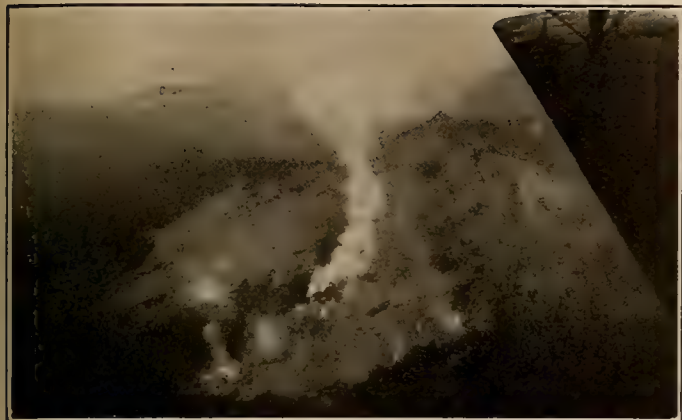
a limited number of lookouts have been placed the suppression agencies largely depend upon the airplane for detection.

As pointed out, stationary lookouts give twenty-four hours' service. At best airplanes serve for a short specific period during the course of their flight. It is for this reason that with the high hazards existing in California, dependence on airplanes for detection, merely based on two daily trips over any given point, would not meet the needs.

Reconnoitering by Airplane

The airplane this year had ample opportunity to demonstrate its use in connection with definite mis-

sions in fire detection and fire suppression. After a severe lightning storm which covered parts of Northern California, special trips were made over the lightning zones. Lightning fires have proved a source of



The preservation of the great timber tracts of the West is greatly facilitated by the airplane patrols, not only on account of the speed with which fires can be reported but also on account of the more accurate mapping of timbered areas which is made possible. The view above shows a fire in Nez Perce Forest, Idaho, photographed from the patrolling airplane.

great trouble. A tree having been struck may smoulder for a good many days before a definite column of smoke of sufficient size to be picked up by our lookouts will be emitted. The airplane has readily detected such fires.

The chief special use of the airplane this year was made in connection with some large fires burning in the northern part of California.

The Mill Creek fire in the Lassen National Forest was located in an extremely inaccessible territory and covered a very rugged, broken country, which made it almost impossible for the Ranger in charge to keep in touch with all sides of the fire. It would have been out of the question for him to have covered the perimeter of the fire in less than a three days' hard journey. A radio station was set up at the main fire camp and an airplane reconnoitered the entire fire-line twice daily and kept the ranger fully informed by radio of the situation. The patrol work of the airplane after the fire was under control saved a good many hundred dollars daily in the wages of fire-fighters as patrolmen, for whom supervision would have been difficult at best. The airplane was used extensively in transporting fire-crew leaders from various forests to points of dire need, saving days of otherwise lost travel time.

Transportation of Trained Forces

The Lassen National Forest had 32 lightning fires start in one ranger district within a two-day period, which taxed the capacity of the regular force. Large crews of fire-fighters were on hand but there was a decided lack in trained forest officers to handle the crews. Immediate action was required. Fortunately, the Stanislaus National Forest was then enjoying a period of quiet, when the "S O S" was received from the Lassen; a plane was dispatched to the Stanislaus and brought back two forest officers who reached one of the large fires that same night. This saved three or four valuable days. Two days later a break occurred on the Stanislaus, and it

called for the return of its men. Again the plane was put into action and the men were back on their forests the same night.

This feature is exceedingly important, making it possible to mobilize and transport our trained forces all over the state. This mobility of trained men was almost entirely lacking heretofore.

Detection Work

In detection the airplane has proved its place. With good trained observers a large percentage of fires can be located within a quarter of a mile. An observer flying over the Shasta National Forest radiographs to the Forest Supervisor, "A small fire, just started in heavy timber, burning slowly, wind N.W." When the plane lands at the base the observer calls up the Forest Supervisor to confirm the message. The local Forest Officer questions whether this is a forest fire, as he had been notified by a cowman that he would burn a carcass in that general vicinity the same day. The observer is firm in his statement. When the Ranger reaches the place, true enough, a small timber fire is slowly eating its way northwesterly up a gentle mountain slope.

Reliability of the Service

By use of radio immediate communication is available to the suppression forces. For the special jobs enumerated no other medium can take its place both as to accuracy and dispatch. Taken in conjunction with the training of an adequate army air personnel, airplane air patrol has a very definite, distinct and valuable use. Twenty millions of acres of National Forest land are viewed practically every day by the observers, besides an enormous area outside, along the patrol routes. Brush and grass fires outside the forests were reported to the state forest authorities, and in this connection the writer desires to record the appreciation of the Forest Service of the splendid spirit of cooperation which was at all times evident with the Air Service, the Signal Service, the State Forester and many public bodies who through direct appropriation of money made possible the preparation of adequate landing fields and the construction thereon of improvements for the housing of the men.

For the number of hours flown—better than 3,000—and for the mileage, which ran up into the hundreds of thousands, the number of casualties was remarkably low. Three men were killed, all through the crash of one plane soon after it had left the landing field at Alturas. But by and large, the air patrol is a safe undertaking, and given good care the great ships are steady, fast and reliable. It is to be very greatly hoped that we shall have a continuation of the Aeroplane Forest Patrol next year and the larger use of wireless telegraphy and telephony.



SUN DIALS were invented in 558 B. C., but if you are going to London, exchange yours for a radium watch:

THE SEARCHLIGHT SECTION
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Cost of Operation for Airplane Service

BY LOUIS H. MUELLER

(The dollars-and-cents practicability of the airplane in commercial life is, next to the safety factor, perhaps the most important aspect for the power man or the business man who is investigating its possibilities. A thorough cost analysis is given below by the sales manager for Walter T. Varney.—The Editor.)

The difficulties of preparing an article on the costs of operating an airplane lies chiefly in the fact that one cannot to any extent rely upon experience as a basis, but must venture predictions on the few facts available. The cost of operating the army planes or war time training planes could not, by any means, serve as a basis for civilian flying, inasmuch as the nature of the flying would be so different; and similarly, the published costs of operation of the aerial mail would hardly serve as an index for the operating costs of the average private owner of an airplane for the same reason. I have divided the costs under the following headings:

1. Fuel and Oil
2. Pilots and Mechanics
3. Depreciation and Renewals
4. Insurance and Minor Breakages
5. Hangar and Field

It will also be difficult to arrive at a final estimate of costs for this particular reason, that the bases of costs in the average in the above mentioned elements differ, one depending on time alone and the other upon the actual amount of flying of the airplane. For instance, the costs under insurance, pilots and mechanics, and hangar and field, depend on time alone. The fuel and oil, and depreciation costs are chiefly dependent upon the amount of flying done.

Since the amount of flying done per unit of time will vary widely with different uses and under different owners, the approximation which will have to be made in order to arrive at a final result per mile, or per minute or per hour, will be an arbitrary figure, and an allowance will necessarily have to be made in each particular case.

Cost Items in a Specific Case

Another difficulty which arises is the fact that there will necessarily be a different operative cost according to the kind of airplane used. Therefore, in order to make this analysis as practical as possible, I shall take for this particular instance the kind of airplane that Mr. Rex Starr, the well known engineer, proposes to use in his surveying trips. This is a medium priced airplane, and one which has been used a great deal in commercial flying. It is known as the Varney Lincoln--Standard, carrying two passengers besides the pilot, and sells at a price of \$6,000.00.

1. Fuel and Oil —

The Lincoln-Standard is equipped with a 150-hp. motor. This is a medium powered motor and therefore will serve as a good illustration. It will normally use ten gallons of fuel per hour of flight, and from two to three quarts of oil. Therefore, the approximate fuel cost per hour of flight would be \$3.00.

2. Pilot and Mechanic —

The ordinary salary for a good pilot is about \$300 per month. For the man who only owns one airplane, the pilot should be picked from among those who have some knowledge of mechanics and therefore would be able to make all minor adjustments upon the plane and the motor. For this reason it will not be necessary to maintain a special mechanic inasmuch as it would be much more economical for the owner in case of serious repairs, or motor overhauling, either to bring in an extra mechanic or to take his airplane to a nearby airdrome where service could be rendered; such service as is being maintained by the Walter T. Varney organization. This would be the most practical way to handle the situation for the ordinary owner.

3. Depreciation and Renewals —

This element of cost is the hardest to estimate in view of the fact that the conditions of commercial aviation are such that, as far as my experience goes, there has been no case of an airplane actually wearing out; and I know that in war time training many a plane was flown for two or three years with very heavy duty. A very conservative estimate of the life of the plane and the motor could be stated as 1,200 hours of flight or operation, this to take place within three years' time, inasmuch as there may be a wearing out of elements due to actual standing around. An airplane is more or less different from an automobile in that it can almost be rebuilt with repairs, so that at the end of perhaps three years there may not be any of the original material present in the plane, but it will still be spoken of as the original plane.

With the above information, which necessarily will vary with individual cases and perhaps not be anywhere near the final figure which will be determined in experimenting, a \$6,000 plane, such as the Lincoln-Standard, could be charged off at the rate of \$5.00 per hour.

Under this element of cost will also have to be placed such items as motor overhauling, re-covering of wings, etc. From our experience we find that motors in our particular instances will run from 75 to 100 hours before they require a top overhauling, that is, grinding of valves, etc., and from two to three hundred hours before the motors must be generally taken down and overhauled and perhaps one or two new bearings, wrist pins, etc., inserted. Then the motor ought to be good again for from 150 to 200 hours before a repetition of this performance. I have no means of knowing how long this could go on before there would be a rebuilt motor on the original foundation.

The cost of the top overhauling of the motor should not be over \$50, and of the general overhaul-

ing not more than \$300. An expenditure of \$150 over 300 hours ought to keep the plane itself in fairly good shape. I believe that for \$2.00 per hour, this element of motor overhauling and plane upkeep could be attended to.

4. Insurance and Minor Breakages —

The insurance rate at this time on commercial aviation is extremely high. We have been obliged to pay a rate of 14% of the amount of the insurance for six months, to cover against losses through fire and through collision with the earth and otherwise. With our Lincoln-Standard plane insured for, say, \$5,000, this would mean about \$700. Taking into account other insurance—for instance, compensation insurance on the pilot and liability insurance, both of which together would amount to about \$600 a year—we would place an approximation of \$165 per month on insurance cost; under the collision insurance clause certain small breakages are exempt in the insurance policies. Therefore we might put a total cost for insurance and minor breakages of an approximate figure of \$200 per month.

5. Hangar and Field —

The cost of storing a plane on a flying field which is to be used will depend entirely upon the conditions, since the average man who will own a plane will have perhaps a ranch or an estate of his own with open spaces. To some the cost of fields will amount to almost nothing; while to others it will come fairly high. A very good hangar could be built for \$1,000. A tent hangar can be purchased for \$300. Inasmuch as this element of cost is not an average cost, it will not be considered in the final result. Hangar space is often sold at very good airdromes for from \$25 to \$50 per month.

Summary of Costs

In combining the above costs to a unit, as before stated, it is necessary to make an estimate of the use of a plane for a given length of time. I would estimate that an average private owner would perhaps not use his plane more than 50 or so hours per month. This of course will make the rate per unit of time higher than if the plane were used more, say 100 hours per month. Fifty hours per month would only represent two hours of flying for twenty-five days in the month, or five hours of flying for ten days. Ordinarily, a man would not want to fly more than five hours in one day. From four to five hours a day was the regular daily work of an army instructor for six days a week.

The time costs would amount to \$500 per month, which is made up of the \$300 for the pilot and \$200 for insurance. The costs depending upon operation could be totaled up to amount to \$10.00 per hour of flight, made up of \$3.00 for fuel and oil, \$2.00 for motor overhaul and plane repair, and \$5.00 for depreciation.

The problem of coordination of these two different types of cost as stated before becomes difficult, and depends entirely upon the use to which the plane is put. Under our assumption of fifty hours of flight per month, we would have the time costs amounting

to \$10.00 per hour; therefore, adding all the costs together we would have a figure of \$20.00 per hour of flight on that basis, or in other words, 33 1/3 cents per minute.

When estimating that a Lincoln-Standard at normal cruising speed makes 75 miles per hour, we would have a cost of approximately 26 cents per mile.

In order to give an idea of the effect of the small usage of the particular plane we took for example, assuming that the plane was used 100 hours per month, which is perfectly reasonable and possible, we would have the time costs reduced to \$5.00 per hour and therefore the total cost of operation amounting to \$15.00 per hour instead of \$20.00. This then, would give an operating cost of 25 cents per minute, or with the same assumption of 75 miles per hour a cost of 20 cents per mile.

These figures would compare very favorably with the operation and depreciation costs of a motor car of the same price as the above mentioned airplane.

In generalizing from the example mentioned above, it may be said that most likely a faster machine would require a higher cost per mile in view of its increased efficiency, in the same way that the higher powered automobiles give a higher operating cost.

It will be well to remember that in practically every element entered above, rather high estimates are made. There may be some objections on the part of men experienced in aviation to some of these costs, but most likely in one category the result would be a higher figure while in other categories very likely they would be lower. I believe that in the average the estimates are high.

It will be well to remember, also, that this cost of 20 to 25 cents per mile of flight includes all costs on the plane except that of hangar and field.

BUSINESS LIBRARY SERIES

On account of the large amount of special material contributed to this issue, the second article of the series on "Pamphlets and Clippings in the Business Library," by Miss Virginia Fairfax, has been held over. The series will be resumed in the November first issue.



BAROMETERS were invented in 1626. If you are well equipped for a rainy day you usually get fair weather:

THE SEARCHLIGHT SECTION
IS AT YOUR SERVICE

The Rise of Civil Aviation

BY LIEUT. H. A. HALVERSON

(The application of wartime aviation equipment to commercial uses, the reorganization of aeronautic bodies, the extension of facilities, the adjustment of regulations—all these activities are significant of the advent of the airplane as a factor in the business world. A member of the U. S. Army air service here gives an inclusive review of what is being done along these lines all over the world.—The Editor.)

The conclusion of the war not only removed certain restrictions on civil aviation but released extensive equipment and organization for possible commercial use. The resultant facilities are leading to marked activity all over the world.

Economic Hindrances in Central Europe

In Austria much thought is being given to air transport. An Aviation Department has been constituted under the State Secretary of Transport, and provisional regulations for air navigation were issued by a decree of December 10, 1919. But so long as the economic situation remains as unfavorable as it is at present, it is unlikely that civil aviation will develop as rapidly as in other countries. One of the main difficulties is the shortage of petrol. The Luft-fahrewesen Gesellschaft (known as "Lufag") has bought up the whole stock of service aircraft. They are being resold under the control of the Disposal Board, 60% of the excess over valuation price realized being credited to the state.

A Department for the administration of civil aviation has been formed in Hungary, the Minister of Commerce employing demobilized officers to assist in this work. This Department is drafting regulations governing the navigation of the air. It is reported that an aerial transport company, known as the "Ungarische Aero-Verkehrs Aktiengesellschaft," has been formed with a capital of 50,000,000 kr. for the purpose of establishing aircraft services. As in the case of Austria, the present industrial and economic state of the country is unfavorable to the development of civil aviation.

Germany's Ministry of Air and Transport

In Germany the organization of civil aviation has been steadily progressing during the last six months, but actual flying has been partially suspended owing to the shortage of petrol and the disturbed condition of the country. Germany now possesses a Ministry of Air and Transport. The Department for Air supervises general questions concerning air traffic, air regulations, aerodromes, aerial photography, the distribution of material, the classification and testing of types, inventions, meteorology and intelligence, wireless telegraphy, and the control of organizations.

The German Government has also established a strict control over the movements of all aircraft. At the beginning and end of each flight proof has to be given of the purpose of the journey. The pilot is obliged to hold a pilot's certificate issued by the State Air Department and, except in the case of flights carried out by air transport companies, a permit issued by the police authorities for each flight. Air transport companies, it is understood, are allowed to issue permits for flights under an arrangement

with the State Air Department, to which they are responsible. All luggage carried by aircraft is subject to special inspection.

A number of new transport companies have been formed, and at present there are 25 such companies in existence. Germany has not yet produced a commercial airplane suitable for civil aviation, but many German engineers are working to discover a satisfactory type.

The Government Department For Air and Power Transport (Reichsamt für Luft und Kraftfahrwesen) has in the supplement to the Home Allowance of the State Transport Ministry for the year 1919 allotted the sum of 500,000 marks as a subsidy for German aviation enterprise. The granting of the subsidy is conditional on the maintenance of air communication and of an air post. In the Home Office grant for 1920, 12,000,000 marks are to be devoted to the same purpose.

The Deutsche Luftreederei has just published a balance sheet for the period February 20, 1919-February 20, 1920. During the year over 3,000 passengers have been carried, and 100,000 kilograms of parcels of goods; 84 machines were used (71 postal airplanes and 13 freighters), which flew 650,000 kilometres.

A Banker's Syndicate in Belgium

A Department of Aviation, autonomous but temporarily attached to the Ministry of War, has been created in Belgium. It is divided into four sections responsible for: (1) the organization of air lines; (2) the exploitation of air lines; (3) general judicial and diverse questions; (4) aeronautical research work.

Navigation Regulations, based upon the International Air Convention, were published on November 27, 1919. Air Attaches have been appointed to London and Paris.

At the present time civil aviation is carried on almost entirely by, or in collaboration with, the National Syndicate for the Study of Aerial Transport which has been formed, mainly by a combination of important Belgian bankers. The Syndicate has prepared a scheme for the provision of facilities on aerial routes for companies with which it has entered into agreement, is arranging to place its organization at the service of the owners of civil aircraft at appropriate charges, and has under consideration the operation of mail and passenger services. During the month of February the receipts from passenger pleasure flying amounted to 34,000 francs, the total expenditure being approximately 20,000 francs. The government has placed 2,000,000 francs at the disposal of the syndicate for the purpose of inaugurating an experimental service of hydro-airplanes and

hydro-glisseurs in the Belgian Congo, a fact which lends weight to a report that it is prepared to grant subsidies for the encouragement of transport companies.

Scandinavia Discusses an Air Code

In Denmark, Norway, Sweden and Finland, further conferences have been held between representatives of the Scandinavian States and Finland with the object of examining the terms of the International Air Convention, and discussing the most suitable form of air legislation.

The first official conference was held in June, 1919, when an air code for these States was discussed. Since that date the conference has assembled at Stockholm in November, 1919, and at Copenhagen in January, 1920. The recommendations with regard to adherence to the International Air Convention rules reached at the last of these conferences are now under consideration by the governments of the respective countries.

Denmark and Norway have appointed commissions under the ministers of Public Work and War, respectively, for the study of air transport and kindred subjects. In Sweden, legislation on civil aviation is effected through the Ministry of the Interior.

An air transport insurance pool representing a combine of some 80 Danish, Norwegian, Swedish, and Finnish insurance companies has been formed. Under its auspices the registration and classification of aircraft and pilots has commenced throughout the Scandinavian states.

Swedish and Finnish companies recently combined to inaugurate a service between Stockholm and Helsingfors, which it is hoped will commence in May or June next. An air ship service between Germany and Sweden has been proposed, and a site for an air-ship station selected near Stockholm. In Norway an official air Traffic Commission has various schemes for air postal services from Christiania to Copenhagen, and the Norske Luftfartrederi, a private company, has prepared plans for opening a number of routes, including that between Bergen and Stavanger.

Governmental Activity in France

The transference by the decree of January 30, 1920, of the "Organe de Co-ordination General de l'Aeronautique" and the departments dependent upon it from the Ministry of War to the Ministry of Public Works and the appointment of an Under Secretary of State for Air mark a fresh step toward the establishment of French aviation on an independent basis. The Under Secretary of State is now responsible for the Air Navigation, Technical, Aircraft Production, and Meteorological Departments, and has created an Advisory Committee for Aeronautics to study problems connected with aviation. A technical Consultative Committee has also been appointed to the Aeronautical Technical Department.

The French have promoted their interests abroad by increasing their representatives and by establishing a number of missions in foreign countries. In addition to an Air Attache at London, Assistant Military Attaches, with the special duty of studying aviation, have been appointed to Washing-

ton, Stockholm, Brussels, Rome and Amsterdam. Official aviation missions have been sent to Argentina, Brazil, Japan, Peru, Poland, Finland, Serbia, Czecho-Slovakia and Turkey.

Consequent upon a reduction in the total French Air Estimate for the current year, there has been a re-grouping of the sums to be expended on civil aviation, with the result that while the subsidies to be given to air transport companies will be augmented, large economies will be effected in the purchase of service aerodromes and hangars. In conformity with the above policy, a new scheme of subsidies has been drawn up, based upon the value of the machine and engine and the number of hours flown. Other salient points are: a bonus to the crew, a premium on useful load and speed, and the additional grant of 25% for machines of military value. In addition to the government subsidy, companies conducting an air mail service receive from the Postal Administration 8 francs for the first 100 grammes, and 1.60 francs for every additional 20 grammes of letters or parcels.

The State has acquired five aerodromes and 24 landing grounds for the use of civil aircraft, and these are placed under the Service de la Navigation Aerienne, which has issued provisional regulations regarding their use. Three aerodromes and six landing grounds have been opened and the remainder are being equipped. Le Bourget and St. Inglevert have been approved as customs aerodromes, and aerial lighthouses have been erected at St. Inglevert and Lille. In addition 13 military aerodromes may be used by civil aircraft belonging to the nations which have signed the Air Convention.

Since September, 1919, an aerial service between Toulouse and Rabat has been operated by the Compagnie de Navigation Aerienne which has obtained a concession from the Spanish Government. The route passes over Spain with stops at Barcelona, Alicante and Malaga. Flights are made twice weekly in each direction. Mails and passengers are conveyed between France and Morocco and by a special arrangement Spanish mails are carried between the intermediate stopping places. The concession granted to the French company is provisional and does not exclude or limit similar grants to others.

Another French company, the Societe Anonyme des Transportes Aeronautiques du Sud-Ouest, has been reconstituted under the title of Compagnie Franco-Bilbania des Transportes Aeronauticos, for the purpose of forming a Franco-Spanish company to open a service between Bayonne, San Sebastian, Bilbao and Santander, by which it is hoped to carry mails from Bilbao to connect with the Paris express at Bayonne, and, in the case of English mails, secure delivery in London on the following day by arrangement with the Paris-London air service. The com-



DAGUERREOTYPES were invented by Daguerre in 1839, but don't use one in applying for a position as long as

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pany would be registered in France in order to retain the right to the French air transport subsidies. A regular service between Nimes and Nice is conducted by the Compagnie, Aeriennne Francaise, a flight being carried out in both directions bi-weekly. The company is subsidized under the government scheme.

The policy of carrying out long-distance flights in order to connect France with her colonial possessions by air is being actively pursued and a successful flight has been made across the Sahara from Algiers via Timbuktu to Kakar.

British Colonial Advances

The body which at present deals with aviation in Australia is a committee of the Prime Minister's Office, called the "Air Services Committee." No air regulations have as yet been drawn up by the Commonwealth Government, but it is understood that the whole question of the administration of civil aviation is now under consideration.

A number of demonstration flights are being conducted by ex-members of the Royal Air Force, and a gift of one hundred airplanes has been accepted from the British Government.

In Canada the Air Board Act was passed in January, 1919, instituting an Air Board consisting of not less than five and not more than seven members, to be appointed by the Governor-General in Council. The functions of the Board, which has been reconstituted under the chairmanship of the Minister of Militia and on which the Naval Service is represented, are similar to those of the Air Council of Great Britain. The Board includes a Superintendent of Flying Operations, responsible for all civil aviation undertaken by the Government, and a Superintendent of Certificates, who controls the licensing of personnel, aircraft and air harbors, and is responsible for civil aviation conducted by private enterprise.

The Associate Air Research Committee, which held its first Advisory Council for Scientific and Industrial Research, will work in close cooperation with the Air Board. The cooperation of the Meteorological Office and the General Superintendent, Government Radio Service, has also been secured.

Dangerous flying was prohibited by Order in Council on July 7, and regulations governing civil aviation, and based on the International Air Convention, were published on January 17, 1920.

The Air Board is giving consideration to the special use to which aircraft can be put in Canada, such as forest patrol and survey work; and authority has been obtained to carry out experiments in phototopographical surveying in the province of Quebec.

The ban on civil aviation in India has been removed, and an Air Board has been set up under the administration of the Department of Commerce and Industry. Its functions are advisory, executive authority for carrying out its decisions being vested in the Department's Member in Council.

In New Zealand an act entitled "The Aviation Act of 1919" was passed in December, 1918, and empowers the Governor-General to make regulations by Order in Council as to the issue of licenses to flying

schools and pilots, the registration of aircraft and prohibited areas.

Civil aviation in South Africa is temporarily under the control of the Department of Railways and Harbors, but on January 25, 1920, a conference was held to consider the best method of controlling and developing civil aviation in South Africa, and the whole question is now under consideration by the Union Government.

The Government is fully alive to the importance of aviation, and has already offered to take over the aerodromes on the Cairo to Cape Town route situated within its territory.

A strong combine of British firms is considering plans for the establishment of air services in the West Indies and Bermuda and its proposals are receiving the attention of the Colonial Governments concerned.

Holland Financing Long Distance Flights

Responsibility for civil aviation in Holland rests at present with the Minister of Waterways and Roads. A Dutch Air Attache has been appointed to Paris. As a means of awakening public interest in aviation in Holland and her colonies the Government has organized a long-distance flight from Holland to Java. It is defraying the expenses of the competitors, and subscribing 10,000 florins towards the prize.

The advantageous position of Holland as a junction for aircraft bound to Scandinavian countries is recognized, and subscriptions are being raised at several important industrial towns for the establishment of civil aerodromes. It is also believed that the Government has given, or contemplates giving, a grant to the municipal authorities of Amsterdam and Rotterdam for the construction of international aerodromes.

A company known as the Royal Air Transport Company for the Netherlands and Colonies, has been founded with the support of important commercial interests. This is a private company which has been granted the title of Royal by the Queen.

The Netherlands East Indian Government has decided, for purposes of meteorological, climatic, and other observations, to execute a daily flight between Batavia and Surabaya. This will be carried out during four months, not necessarily consecutive, and seaplanes and airplanes will be employed alternately.

Mail Service in Italy, Spain and Switzerland

In Italy the General Directorate of Aviation under the Minister of Transport, constituted by a royal decree of June 30, 1919, is still responsible for the administration of civil aviation, and controls the Technical, Supply and Experimental Departments of military aviation and training schools. It is, however, reported that the appointment of an Under-Secretary of State for Air is contemplated. A royal decree for the regulation of air navigation came into force on January 3, 1920. The Government is sparing no pains to promote Italian interest abroad, and it is estimated that 16 Air Attaches have been appointed to various countries. In addition to these, missions have been dispatched to Japan, Peru,

Poland, Serbia, Czecho-Slovakia, Finland, Indo-China and Turkey. As an example of the expenditure incurred in these missions, it is interesting to learn that the initial cost of the mission to Argentina was 6,000,000 lire, in addition to 350,000 lire a month for running expenses. Italy has also realized the importance of securing a market in the East, and for this purpose a demonstration flight has been made from Rome to Tokio. In connection with this flight a number of machines have been sent to China and are being exhibited at Shanghai.

A number of former service aerodromes have already been opened for civil aviation, and passenger and postal air service between Italy and Greece is being operated as an experiment by the Italian Government. A flight is made in both directions twice a week. Air postal flights have also been carried out by the Italians between Athens and Crete. With a view to advertising Italian machines a demonstration flight employing six seaplanes is expected to leave Naples for Sweden shortly. The development of air communication in the Italian colonies is also receiving attention. A service between Eritrea and Somaliland is being organized, while the possible use of air transport in Tripoli and the Libyan Provinces is under consideration. A feature of State aid is the proposed institution of civil aviation in schools and university courses at Rome and Turin. As an indication of the methods by which the Italian Government proposes to assist private enterprise, it may be mentioned that a Sardinian company is reported to have obtained a concession for running a service between Rome and Sardinia which includes a subsidy of 660,000 lire, and the free use of aviation material in Sardinia to the value of 15,000,000 lire.

The Ministry of Finance in Spain, under Royal Order, has fixed the rates to be paid for correspondence sent by air mail. Until special stamps are brought into use mail matter will be franked with the ordinary stamps surcharged according to the rate of the aerial post. All ordinary letters and money orders can be sent by aerial post, up to a weight limit of 500 grammes. Registered and insured letters and parcels are not carried and the Post Office accepts no responsibility for loss or damage. The technical inspection of air postal services will be conducted according to the regulations fixed for civil aviation, and an inspector for this duty will be appointed by the Director-General of Posts and Telegraphs. The air mail service between Barcelona and the Balearic Isles has been organized by an association of Mediterranean shipbuilders. It was inaugurated on March 18, 1920, and a preliminary flight has already been made. Italian seaplanes are to be used. A postal service between Barcelona, Alicante and Malaga has been authorized by the Director-General of Posts and Telegraphs, and inaugurated by the French Latecoere Company.

In Switzerland steps have been taken to dissociate the control of military and civil aviation, by transferring the latter from the Minister of War to the Minister of Posts and Railways, under whose administration a Bureau of Civil Navigation was opened on April 1st. This step has been hastened

by the opening of the air traffic with England and France as a result of the temporary agreements with those countries, which came into force on March 1st. In the first instance, the Bureau will be provided with a small staff only and its duties will apparently be of a limited and tentative nature. Among its functions will probably be the supervision of examinations for pilots carried out by the Swiss Aero Club, and the encouragement of research. On January 27, 1920, the Government published Air Navigation Regulations governing flight over Swiss territory. The Swiss "National Aviatik" Company of Dubendorf has taken over from the Government the air service which formerly carried mails between Dubendorf, Berne, Lausanne and Geneva.

Promotion Work in the Far East

Foreign countries are continuing their endeavors to open up Chinese markets for their products, and in view of the predominant position which the French hold in the Chinese Postal Administration, it is not unlikely that they will make a strong bid for the privilege of inaugurating an air postal service. Italy is also making an effort to secure a footing, and a report was received towards the end of January, 1920, that a shipment of Italian airplanes had arrived at Shanghai, where the machines were on view. The Anglo-American Tobacco Company is reported to have decided to use airplanes to carry their men and medical supplies into the interior. An American company is reported to have shipped in January seaplanes to Hong Kong for operating commercially on the coast of China and adjacent waters.

In Japan, during the last six months, aviation has made little progress. There are signs, however, that the necessity for an efficient air service is recognized. A special committee has been appointed to deal with civil aviation, and it is expected that as a result of its deliberations, a permanent Aviation Board composed of eight representatives from the Army, four from the Navy and fourteen from the Civil Service will be established. The president of the Japanese Imperial Aviation Association is touring through Europe and America in order to make a thorough investigation of civil aviation. Two companies have been formed with the object of inaugurating air services.

South American States

Considerable interest in aviation is displayed by all the South American states. France, Italy, the United States and Great Britain are entering into keen competition to establish markets for their aircraft products. There exist at present three Air Transport companies: (a) The Compania Franco Argentina des Transportes Oereos, among the objects of which is to represent the French aviation industry in Argentina; (b) the Compania Argentina



ARTILLERY was invented by Schwartz in 1330. If your children are restless buy them a second-hand howitzer.

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des Transportes Aereos, which is closely associated with the firm of Sanes Mai and Company; (c) the Sociedad Rio Platense de Aviacion. A new mission from Italy (the second) arrived at Buenos Aires on March 29. This mission was sent by the Italian Ansaldo Company, and is composed of a number of pilots and mechanics, to be followed by some machines. The United States are represented by the Curtiss Aeroplane and Motor Corporation.

The French have obtained valuable contracts in Brazil, partly as a result of the efforts of their mission which was established in the country as far back as October, 1918, one of which is to equip and train the Brazilian Air Service. The Italians have also sent a mission to Brazil, but beyond carrying out propaganda it does not appear at present to have achieved any definite results.

Colombia offers exceptional opportunities for the employment of aerial transport, as throughout the greater part of the country the only other means of communication are the river Magdalena and a limited mule service. On April 11, 1919, a resolution, signed by the Minister of the Interior, was adopted, calling for public tenders for the transport of mails by air. The French have already obtained connections in this country, and in accordance with a contract entered into with the local Compania Colombiana de Navegacion Aerea (capital £160,000) have undertaken to send out an expert staff of pilots and mechanics to build suitable aerodromes and establish services between various towns.

Peru is very mountainous and offers but few places in which airplanes can land with safety. Sea-planes could be used to advantage as the coast is practically free from storms during the whole year. In August information was received that the Peruvian Postmaster had been authorized to ask for tenders from European and American firms to establish an air route between Tarma and Inquitos for the transportation of mail, passengers and freight.

Outlook in the United States

The creation of an Air Department has not yet materialized. Senator New's bill to effect this was discussed by Congress, but after meeting with considerable opposition, based on the expenditure involved, it was returned to the House Committee on Military Affairs for review and amendment. There is, however, growing recognition of the importance and great possibilities of civil aviation throughout the country, and in view of favorable factors such as long distances, an equable climate and financial prosperity, it is probable that civil aviation in the United States will develop quickly as soon as public confidence has been secured. A number of states and cities have brought forward independent measures for the regulation of civil air navigation. In this respect it appears that a lack of co-ordination of legislation may result as in the case with the United States motor laws. In the absence of Federal legislation, the United States Air Service has formulated rules of the air as a guide to pilots. A bill was introduced on February 26 in the State Assembly of New York to regulate the use of aircraft, and after first reading it was referred to the Committee of the Judiciary. Official effort is principally confined to the operation of mail service from New York to Washington and Chicago, for which the Post Office claims a considerable measure of success, and to the forest patrols. A number of air transport companies, such as the North American Aerial Transportation Company, are being formed and aircraft exhibitions have been held. The only noteworthy achievement overseas has been the inauguration in the Philippines of a daily mail service between Manila, Fort Mills and Santa Cruz. An aerial "Derby" around the world is now in course of organization and a special mission is touring the different countries for the purpose of making a preliminary plan. The mission has already visited Japan, China, Dutch East Indies, and French Indo-China.



MOSAIC OF MURRAY DAM

This remarkable picture of the Murray Dam, located just below the site of the famous old La Mesa Dam which was one of the early hydraulic fill dams of California, is made up from fifteen different airplane photographs taken from an altitude of 5200 feet. The Murray Dam is of the multiple arch type, 117 feet high, has a crest length of 900 feet and makes a reservoir of 6,750 acre-feet. These pictures were taken by Lt. L. W. Miller, U. S. Army, under the direction of Lt.-Col. H. B. S. Burwell, and the mosaic is reproduced here by the kindness of Colonel E. D. Fletcher of the Cuyamaca Water Company which owns the Murray Dam.

Trouble Shooting in Gold and Silver Mining

BY B. B. BECKETT

(Maintenance of equipment is a practical problem closely affecting the question of economy. Previous articles written by the same author, and published in the issues of March 15th and May 1st, treated of power requirements and choice of equipment respectively in the mining of precious metals. The following article deals with the prevention of time and labor losses resulting from failures of equipment, the principles being applicable of course to electric drive in any service. The author, now a consulting engineer, was formerly electrical engineer for the Goldfield Consolidated Mines, Nevada.—The Editor.)

Successful operation of electric drive equipment is chiefly a matter of preventing trouble. It is of first importance that the number of failures and also the total time lost be kept to a minimum, and yet it is peculiarly difficult to prevent failures in such service. The number of failures is, of course, dependent upon the severity of the conditions, but also varies directly with the number of hours in serv-

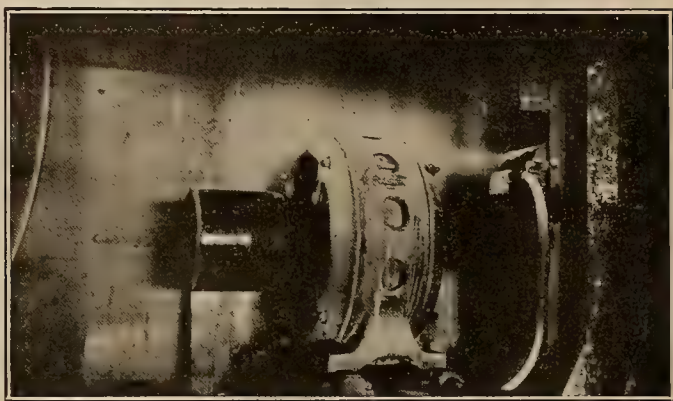
These are very readily repaired when found, but are often very puzzling to find and for this reason may cause several hours' delay. They are important also because they sometimes result in motor burn-out by leaving the motor running single-phase.

Spare Equipment and Parts

It is good practice to carry spare motors for all small motors, up to 100 hp., and a complete set of



The two tube mill motors, Allis-Chalmers 200 hp., at the Goldfield Consolidated mill. The average load is about 220 hp., and the motor at the left has operated for eight years continuously without trouble.



One of the five stamp motors, Allis-Chalmers 60 hp., at the Goldfield Consolidated mill. These are underneath the ore bins in a dark and very dusty location, but operate under an average load of 42 hp., giving very little trouble.

ice, and it is to be remembered that most mill motors are in service 24 hours per day and every day in the year. It is difficult to give proper care when motors can be shut down only upon permission of the men whose duty it is to get the maximum production, and it is difficult to make proper repairs under the stress of hurry to get going again.

At Goldfield, failures averaged four or five per month out of about 110 motors connected. Of these, only about one in four was a shop job, that is, so serious that the motor was sent to the shop for re-winding. This number of failures is high, due to the fact that most of these motors were old and had been several times repaired. In good average practice, with modern equipment, half this number may be expected.

Failures in starters are almost as common as motor failures but of much less consequence. The great majority are contact troubles that are readily repaired. There were a number of starter burn-outs in Goldfield, due usually to starters being left on starting position, but this is rare with modern starters having spring handles.

Failures of transformers are very rare. There is only one other class of failures common enough to require mention here, viz., open lines, due almost always to local heating resulting from high contact resistance at some bolted or spring held terminal.

spare coils for larger motors doing essential duty. One spare motor will serve for a number of the same or slightly smaller size up to some six or eight, and beyond that another spare should be provided. Spare coils also should be provided when one motor is serving for as many as six, as the loss of one would leave the others uncovered until the first is re-wound. Regarding spare bearings, these are of doubtful value as a burnt-out bearing usually means a burnt-out motor, or one so damaged that the bearing can be re-babbitted while the motor is being repaired, and hence without additional loss of time. It was once the practice to carry spare rotor bars. This is not worth the cost, even with bolted construction. It is not usual to carry spare laminations, as cases are rather rare where laminations are damaged so badly that they cannot be used again after separating and restacking. Spares need not be carried for hoist motors, as these, being always under control, are rarely damaged beyond a few coils, which can be cut out.



DYNAMITE was invented by Nobel in 1867.
Don't keep it stored in the basement;
somebody can use it.

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Starter contact parts should always be carried, as many as necessary to insure always having a supply on hand. Spare transformers or parts are not recommended, except in extreme cases, as when transformers are dangerously overloaded already.

Causes of Failures

Based upon our experience at Goldfield, the more common causes of motor failures are given in the order of their importance in the following table:

1. Vibration, or shaking.
2. Dirt in oil.
3. Water on winding.
4. Overload.
5. Loss of one line connection (single-phasing).
6. Original defect.

These are the primary causes. Ultimate failure is usually due to a succession of events, and often a secondary cause is blamed whereas the trouble could have been prevented only by removing the primary cause. For instance, vibration may cause bearing enlargement permitting rotor to rub stator, which will burn insulation, eventually causing failure by ground or short. Vibration, the most prolific trouble maker, may result from the following conditions:

1. Gear drive.
2. Unbalanced pulley.
3. Badly spliced belt.
4. Unbalanced rotor.
5. Connected or adjacent machines.

The most destructive form of vibration is not a visible shake but a fine sharp buzz that can be best detected with the finger nails or with a steel against the teeth. It may cause:—

1. Broken connections in stator or wound rotor.
2. Broken rotor bars.
3. Broken main frames.
4. Bearing enlarged by constant rubbing.
5. Oil thrown out by splatter.
6. Oil plug shaken loose and out.
7. Bearing set screw out, permitting bearing to turn.
8. Oil ring, if split type, shaken apart.
9. Oil soaked windings.
10. Sparking at slip rings and commutator.
11. Rotor core bolts loose or broken.

These are only the immediate results, as each may lead to something else. For instance, a broken connection may result simply in a trouble call and quick repair, but it may also result in a badly scorched winding if the motor continues to run on single phase. Broken rotor bars are of little consequence as a rule, but if many bars are out of place, the resultant unbalanced magnetic pull may be powerful enough to draw the rotor over against the stator, thus burning laminations and coils. Bearing troubles due to vibration have about the same results as if due to dirt in the oil, the second most common primary cause listed above. This may be merely renewal of babbitt at convenience, but may be babbitt melted out and motor stalled, or rotor allowed to drag on stator until burn-out follows. Oil on windings, besides being objectionable from the standpoint of cleanliness, is itself a common cause of motor failure. It collects dirt, raising the temperature by impeding ventilation, and it dissolves out the insulating varnishes, aiding the entrance of moisture. If copious, it loosens the coils so that they move constantly and rub against each other until the insulation is worn through.

Sparking, besides causing rapid wear of brushes and rings or commutator, may fill the winding with carbon dust until bad flashing occurs; sometimes accompanied with destructive arcing between exposed terminals or coil ends.

Water on windings is not as serious as it sounds. If there is any damage at all, it is usually a simple ground or short which can be quickly repaired. In case of complete soaking, it is, of course, necessary to dry out the motor, else it may be entirely burnt out by distributed leakage. The delay for drying is usually the worst result.

Overload seldom causes immediate failure. If accidental and severe, it will usually open protective devices. More often the winding is repeatedly scorched, or gradually carbonized by carrying just a little too much, until failure finally results from distributed leakage. A complete new winding is then required.

Single-phasing, as it is sometimes called, does no harm if the load is not more than about 60% of what the motor would carry normally; and if more, then the effect is that of an overload. It results from one line connection becoming open somewhere, usually in the starter contacts, often at a terminal lug that has heated up from high contact resistance, and sometimes it results from the blowing of a single fuse. This last is also often due to heating of terminals from high contact resistance.

Original defects in motors, such as poorly soldered connections, insulation torn at edge of slot when coil was forced in, etc., do not always show up at first but stand until developed by some other primary cause, as vibration or overload. They are rare.

All of the troubles and causes listed above were actually encountered at Goldfield in one or more instances, and the writer has had experience of many of them elsewhere. Bearing troubles of one sort or another are the most frequent, constituting more than half of all motor troubles, and are also the most destructive, since they so often result in rubbing in the air gap. This is the worst thing that can happen to a motor as it damages both coils and laminations. Many re-wound motors are below par because their laminations have been injured and not replaced.

Inspection

In any large mill, the electrician should make a regular routine inspection every morning, with motors running, and should arrange for a shut-down for more complete inspection and cleaning of each motor and starter every ten days or two weeks. The daily routine inspection may be omitted for motors seldom used and those having special attendance as hoist motors and pump station motors. In this inspection, motors should be examined for temperature, hot bearings, oil conditions, vibration, and as to danger from dripping or splattering water and water brought up by the belt. The last two, when they cannot be corrected by the man on shift, should be reported to the superintendent, and if not promptly corrected, should be reported in writing. At the more careful inspection, when motors are shut down, the air gap should be gaged by means of a set of

steel gages of several different thicknesses and a record kept in a note book, or on special forms, of the clearance in the air gap, top, bottom, and each side. By keeping a continuous record of each motor, it will be possible to note the progress of wear and thus determine when bearings should be renewed. For appearance sake, motors should be wiped off on the outside, but no attempt should be made to clean them internally except when in the shop for repairs, or when so badly choked with dirt that ventilation is reduced to such a degree as to cause dangerous temperature rise. The practice of blowing out motors periodically with compressed air is not good, as air frequently contains moisture, and also dirt is sometimes blown into bearings or into parts of the winding where it will do more harm than before. Dry dust on a motor, if the bearings are protected, is quite harmless; and if caked on with oil from leaking bearings, it can only be removed effectually in the shop.

Starters should be examined at the same time as the corresponding motors and their contacts filed smooth or renewed. The oil in starters requires little attention except to see that it covers all contacts and that the mud in the bottom is not deep enough to touch conducting parts. The low voltage release should be kept clean so that it does not stick.

Transformers and oil switches other than starters should be inspected twice a year, mainly to see that the oil is at proper level, that is, covering all exposed terminals and connection boards. In the case of high tension transformers, 15 kv. and over, the oil should be examined also for moisture and carbon.

Occasionally all switch lugs and unsoldered contacts carrying heavy currents should be examined for high temperature, as they are always liable gradually to heat up from oxidation even though they have been in service for years. This is particularly true of switches and fuses that are rarely opened. Use tends to break the oxide film. Moisture seems to have a similar effect, and oil or grease on contacts tends to prevent oxidation by excluding air. Many blown fuses are the result of contact heating. The inspection should be made by a responsible man, not left to a mere helper.

Lubrication

Any good mineral oil is satisfactory for motor use, provided it is clean, is thick enough not to be thrown by the rings, and thin enough to flow freely at normal temperature. In general, large bearings require heavier oil than small ones. If the oil is too stiff, the bearing will warm up to a point where the oil will be thin. If the rings are throwing the oil by running too fast, this may be stopped by using a heavier oil. But this throwing of oil may be due to a bent ring, or to vibration. Whatever the cause, it should be stopped if possible, for the flying drops of oil, although caught by the housing, will usually crawl to the edge and saturate the dust guard, if there is one, or drip down on to the shaft. The menace to the bearings from loss of oil may be nothing, but this oil will usually get into the winding,

either along the shaft or by flying in with the draft of air from the under edge of the housing. A few drops a day will eventually saturate the winding.

The practice of oiling motors every little while, whether needed or not, and particularly through the covers, is very bad though all too common. Oil should be put in only through the oil gage, and never without ascertaining the cause of its being low and correcting it if possible; for oil does not dry up or wear out. If low, it must have leaked out and probably has gone into the winding. If a bearing is running properly, it need never be touched and need never have a drop of oil added, not within the ordinary life of machines. Putting oil in through the cover is almost certain to result in getting dirt in on the bearings. In cases where operators cannot be taught to refrain from doing this, the covers should be wired down. The cover is for inspection, and when the fact has once been ascertained that the rings always start and run properly, the cover need never be raised.

Barr bearings have been advocated as a means of preventing bearing troubles, particularly rubbing in the air gap. The writer's experience is not sufficient on this point except to indicate that ball bearings are quite as sensitive to dirt and to vibration as are babbitt bearings. They do prevent the oil nuisance and probably would reduce the number of cases of rubbing.

FEDERAL POWER COMMISSION ORGANIZATION


The newly created Federal Power Commission plans, among other things, to compile improved statistics concerning water-power resources, their utilization and distribution. This work will be done in



Geographical divisions of operation under the Federal Power Commission

cooperation with the electrical industry and with the public utility commissions of the various states.

The heads of divisions into which the Federal Commission is divided are to be known as chief engineer, chief accountant, chief counsel, and chief clerk.



ELECTRIC ARC LIGHTS were invented by Davy about 1830. If you can't see your way to getting what you want,

THE SEARCHLIGHT SECTION IS AT YOUR SERVICE

Air Draft Required for Fuel Oil

BY ROBERT SIBLEY AND C. H. DELANY

(Is the actual draft available in your steam power plant sufficient to bring about the greatest economy? Here are some recent research notations on this important and timely problem by the authors of the text book entitled "Elements of Fuel Oil and Steam Engineering," which is soon to make its second appearance on the market, greatly enlarged and illustrated with over two hundred distinct charts, photographs and diagrams. This second edition is being published by McGraw-Hill Book Company, New York City.—The Editor.)

For every kind of fuel and rate of combustion there is a certain draft with which the best general results are obtained. A comparatively light draft is best for burning bituminous coals and the amount to use increases as the percentage of volatile matter diminishes and the fixed carbon increases, being highest for the small sizes of anthracites. Numerous other factors such as the thickness of fires, the percentage of ash and the air spaces in the grates bear directly on this question of the draft best suited to a given combustion rate.

For fuel oil, the question of draft required is greatly simplified by the fact that the air does not have to be drawn in through a thick bed of fuel and there are no ashes or clinkers to further complicate the matter. The resistance offered to the entrance of air to the furnace is caused by the checkerwork furnace floor, and as the openings in the checkerwork can be altered at will, it is evident that the amount of draft required in the furnace will depend largely on the arrangement of checkerwork adopted.

For a furnace arrangement in which the total net area of free air space amounts to 3 to 3½ sq. in. per rated horsepower of the boiler, the draft required in the furnace amounts to the following, approximately:

Per cent of rating	Draft in furnace
100	0.05
150	0.10
200	0.25

The draft in the furnace is only a small proportion of the total draft that must be supplied by the chimney, for it is necessary to add to the furnace draft the draft loss caused by the friction of the gases in passing through the boilers, breechings and flues leading to the chimney.

Draft Losses in Steam Power Generation

The loss of draft is greatest in boilers having the longest path of gases, the greatest velocity, and the greatest number of changes in direction of flow of gases. A boiler having a single pass with the hot gases entering at the bottom and leaving at the top has a minimum draft loss. In most designs of boilers, however, this arrangement cannot be adopted as the area of gas passage would be too large. This would result in the gases short circuiting, that is passing in a narrow stream from one corner to the other without coming in contact with all of the heating surface. To make the heating surface effective in absorbing heat from the gases it is therefore necessary to provide baffles in the boiler, which deflect the gases and cause them to travel back and forth until their temperature has been reduced as much as possible.

The arrangement of baffles is a feature of boiler design and need not be entered into here. It is well, however, to refer briefly to the general principle involved, namely, that the higher the velocity of gases traveling over the heating surface the greater will be the coefficient of heat transfer. Consequently it would seem that in order to insure maximum efficiency of the boiler there should be a large number of passages of small area, so as to insure high velocity of the gases. This is true up to certain limits, but unfortunately it is soon found that the additional loss of draft caused by increased friction and extra changes in direction of the gases makes the production of the required draft both difficult and expensive.

In the majority of water tube boilers the baffles are arranged for three passes, that is the gases are forced to travel the length or height of the boiler setting three times before reaching the stack. With this arrangement the areas of passes are such as to give the gases a velocity of 10 or 15 ft. per second when the boiler is operating at its rated capacity. By increasing the number of passes to four or five the velocity may be increased to 20 or 30 ft. per second. This results in a higher rate of heat transmission so that more heat is absorbed from the gases, reducing their temperature and resulting in less waste to the chimney.

To enable the number of passes in a boiler to be increased the chimney must be designed to suit the increased loss of draft that will occur. Thus in every case the actual draft loss should be determined as closely as possible, and the actual figures for the particular case in hand used in designing the chimney. It is desirable in all cases to design the stack for a greater draft than is expected, for it is a simple matter to reduce the draft by closing in on the damper, whereas if the draft is insufficient nothing can be done to increase it. Again, it may be desired at some future time to increase the number of passes in the boiler, or otherwise modify the baffles in such a way as to require more draft. This would be impracticable unless the stack is large enough to produce a surplus of draft.

In order to give the reader some general ideas of computations involved in ascertaining draft losses assumed in design we shall now pass to a brief consideration of this problem.

Loss of Draft in Boilers.—The loss of draft through a boiler proper will depend upon its type and baffling, and will increase with the per cent of rating at which it is run. For design purposes, it may be assumed that the loss through an oil fired boiler between the furnace and the damper will be 0.15 in. when it is run at its rating, 0.35 in. at 150

per cent of its rating and 0.60 in. at 200 per cent of its rating.

Losses in Flues and Turns.—With circular steel flues of approximately the same size as the stack or when reduced proportionally to the volume of gases they are to handle, a convenient rule is to allow 0.1 in. draft loss per 100 ft. of flue length and 0.05 in. for each right angle turn. These figures are also good for square or rectangular steel flues with areas sufficiently large to provide against excessive frictional loss. For losses in brick or concrete flues these figures should be doubled.

Thus the loss in draft flues and turns for an installation having a flue 100 ft. long and containing two right angle turns is

Loss for flues, per 100 ft.	0.1 in.
Turns 2×0.05	0.1 in.
	<hr/> 0.2 in. loss

Total Available Draft Required.—We are now enabled to compute the total available draft required for a boiler installation by summing up the separate components required for the furnace, for the boiler, for the flues and for the turns.

Thus, for an oil fired boiler to operate at 200 per cent of its rated capacity, connected to a chimney through a flue 100 ft. long and containing two right angle turns, we have the following:

Draft in furnace	0.25 in.
Draft loss in boiler	0.60 in.
Draft loss in flue.....	0.20 in.
Draft required at base of chimney	1.05 in.

Artificial Draft.—As we have seen draft in a stack is caused by difference in pressure between the gases inside and outside, resulting in a flow of air from the higher external pressure to the lower internal pressure. A similar difference in pressure, and consequent flow of air, may be produced by a fan or blower instead of by a chimney. When this is done we have what is known as Artificial Draft.

There are two forms of artificial draft known as Forced Draft and Induced Draft, the distinguishing feature between the two being the location of the fan in respect to the boiler.

In the case of Forced Draft the fan sucks air direct from the atmosphere and delivers it to the boiler, under pressure somewhat greater than that of the atmosphere. In the case of Induced Draft the fan is located between the boiler and the stack, sucks the gases of combustion out of the boiler and discharges them to the stack.

Since Forced Draft produces a pressure greater than atmospheric, its use is confined principally to forcing air through a thick bed of fuel on the grates. It is used largely in connection with certain kinds of stokers, and frequently with hand fired boilers using low grade coals. Forced draft is not suitable for steam atomized oil-fired boilers, because there being no fuel belt on the grates to offer resistance, the positive pressure from the fan discharge would be carried up into the boiler setting. This would cause the gases to leak out into the boiler room, and in some cases would result in excessive furnace tem-

perature and burning out of the brickwork. For satisfactory operation of stationary boilers it is necessary to keep the pressure of the gases within the boiler setting slightly lower than atmospheric pressure. When forced draft is used the positive pressure should not extend past the ash pit. Forced draft is used extensively with Mechanical Atomizing oil burners, where owing to the small area for air admission it is impossible to get into the furnace enough air for high overloads by means of natural draft.

Induced draft can be used instead of natural draft wherever desired. It is cheaper to install than a high stack, but the power required to drive the fan makes it more expensive to operate. It is of especial advantage where the gases escaping from the boiler are passed through an economizer to absorb some of their heat, before they are allowed to reach the chimney. The economizer introduces added frictional resistance to the gases so that extra draft is required. Besides this, the economizer reduces the temperature of the gases to such an extent that to obtain sufficient draft without a fan would require a stack of excessive height. By installing an induced draft between the economizer and the stack, ample draft can be obtained regardless of the height of the stack or the temperature of the gases.

Induced draft is also of value, even when economizers are not employed, in cases where it is impracticable or undesirable to build a stack of normal height. An example of this is found in the power plant of the University of California, where a high unsightly stack would seriously interfere with the architectural features of the university buildings. By building a stack only 50 ft. high, and supplementing it with an induced draft fan, this difficulty was overcome.

AN AMERICAN GOLD DREDGE FOR NEW ZEALAND FIELDS

An example of the far-reaching activities of American industry is to be found in a gold dredge that has been designed and constructed in New York for the purpose of operating in New Zealand gold fields. This dredge is being built by the New York Engineering Company and is along the type of dredge constructed for operations in Alaskan fields. The hull is 115 feet 6 inches overall, beam 50 feet, depth 11 feet, and is built of Kauric pine. Power for dredging, pumping and shifting position is furnished by Westinghouse electric motors, while twelve men, four men to a shift, constitute the crew.

Dredges of this type have operated on a cost basis of $6\frac{1}{2}$ cents per cu. yd. and in one instance where records are available, 418,745 cu. yds. have been dug in a period of two years.



AIR BALLOONS were invented by Gasmac in 1729. If you are up in the air try advertising for a position:

THE SEARCHLIGHT SECTION
IS AT YOUR SERVICE

Problem Course in Electricity

BY H. H. BLISS

(The toaster on your breakfast table converts electrical energy into heat. The simple mathematical processes by which you can figure the amount of energy required to produce a given amount of heat or mechanical energy, are described below in the seventh of a series of practical articles. The author is on the staff of the Riverside Junior College at Riverside, California.—The Editor.)

TRANSFORMATION OF ENERGY

Kilowatt-hours and Horsepower-hours.—If the motor in Fig. A absorbs 5 kw., the lamps take 1400 watts, and the line loss is 600 watts, what is the output of the generator in 3 hours? The power output is evidently 7 kw., whether the generator works one minute or 24 hours, but the amount of electrical energy it supplies to the circuit depends upon the time. We say that 7 kw. for 3 hours makes

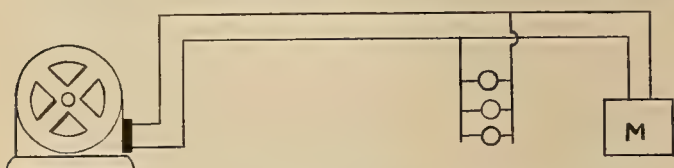


Fig. A. Diagram of circuit including generator, motor and lamps, illustrating calculations for transformation of energy.

a total of 21 "kilowatt-hours" (abbreviated "kw-hrs."), defining one kw-hr. as the energy supplied in one hour if the power is one kw. The rule is: "No. of kw-hrs. = no. of kw. \times no. of hours" (provided the power is constant or uniform during the time).

What is the output of the motor in the same figure if its efficiency is 90%? The power output is $5 \times .90 = 4.5$ kw. = 6 hp., and the energy output, or work done, is $6 \times 3 = 18$ "horsepower-hours," where the definition is analogous to that above.

It is to be noted that we multiply power by time to get a measure of the energy used up or work done, and it is this, rather than the power, for which we are charged in a bill for electric current. What is the value of the energy lost in transmission in the preceding example, if it costs the power company 2 cents to generate 1 kw-hr.? $600 \times 3 = 1800$ "watt-hours" = 1.8 kw-hr. Then $1.8 \times 2 = 3.6$ cents.

Since it is energy and not power that is paid for, the meter used is not a "wattmeter" but a "watt-hour meter," an entirely different instrument. What is the meter reading and the cost for a month if a family uses six 40-watt lamps 4 hours a day and the price of energy is 8 cents per kw-hr.? $6 \times 40 \times 4 = 960$ watt-hours per day; $30 \times .96 = 28.8$ kw-hrs. Cost = $28.8 \times .08 = \$2.30$.

Mechanical Energy.—If a one-hp. engine operates for one second it is able to lift 550 lbs. one foot vertically. This amount of work we might call one "horsepower-second." It is more often designated as 550 "foot-pounds," where one foot-pound is the work of lifting a pound weight one foot (or moving any object for a distance of one foot against a resistance of one pound). This is, then, a simple and direct unit for the measure of mechanical energy.

One hp. is 550 ft. lbs. per second. A "horsepower-minute" = $60 \times 550 = 33,000$ ft. lbs.; a horsepower-hour = $60 \times 33,000 = 1,980,000$ ft. lbs. Then one kw-hr. = $4/3$ of this, or 2,650,000 ft. lbs.

The motor in Fig. B is 85% efficient; it lifts a mine hoist weighing 2000 lbs. a distance of 1400 ft. What is the cost of electric energy consumed, at 4 cents per kw-hr.? $2000 \times 1400 / .85 = 3,300,000$ ft. lbs. = input to motor. $3,300,000 / 2,650,000 = 1.25$ kw-hr., costing 5 cents.

Electricity and Heat.—Whenever current flows through a conductor it produces heat therein. The heat either raises the temperature of the conductor or escapes to the surrounding material. This is often practically useful, for it forms the basis of all electric heating, lighting, cooking, welding, etc. The enormous use of electricity for lighting is largely responsible for the rapid expansion of the electrical industry.

It is well to note that there is a distinction between "heat" and "temperature." A hot body may contain less heat than one much cooler, as will be

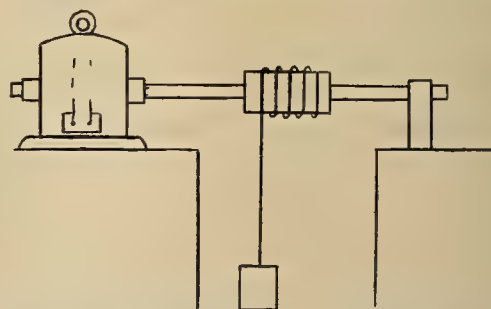


Fig. B. With a motor 85% efficient lifting a mine hoist weighing 2000 lbs. a distance of 1400 ft., what is the cost of electric energy consumed, at 4 cents per kw-hr.?

seen by comparing the heat necessary to bring a cupful of cold water to the boiling point with the heat necessary to raise a tubful of cold water to the temperature of a hot bath. A thermometer will show the cupful of water to be hotter, but the gas meter will indicate that tubful took far more heat.

Heat is one form of energy and hence can be measured in such energy units as foot-pounds or kw-hrs. The simplest unit is, however, the "B.t.u." or "British thermal unit," which is the heat required to make one pound of water one degree warmer. What heat is necessary to bring a tubful of water (say 300 lbs.) from 60° to 100° Fahr.? It takes 40 B.t.u. to warm one lb. of water by 40° (60 to 100); $300 \times 40 = 12,000$ B.t.u.

Calculating Heat Developed.—Numerous tests have shown that when mechanical energy is converted into heat by friction, one B.t.u. is developed for every 777 ft. lbs. used up. Hence one hp-hr. would produce $1,980,000 / 777 = 2545$ B.t.u.; one

kw-hr. gives $4/3$ as much, or 3412 B.t.u. These figures make it very simple to calculate how much heat will appear for any given loss of mechanical or electrical energy.

For example: A certain electrical device known as a "transformer" may have an efficiency of 95%. Coils of pipe carrying water are used to remove the heat developed by the electrical losses. How many B.t.u. are taken by the water in 60 hours if the input to the transformer is 8 kw.? Loss = 5% of 8 = .4 kw.; $60 \times .4 = 24$ kw-hrs. This = $24 \times 3412 = 82,000$ B.t.u. If 1300 lbs. of water at 50° Fahr. enters the system during this time, what is the temperature as it leaves? Since the number of B.t.u. = lbs. \times degrees rise, the rise = B.t.u./lbs. = $82000/1300 = 63^\circ$. Final temperature = $50 + 63 = 113^\circ$.

Transformation of Energy.—As in the example above, electrical energy is readily turned into heat. So also is mechanical energy, as in all cases of friction. It is more difficult to change heat energy into one of the other forms, yet it is often done, by means of such "prime movers" as the gasoline engine and the steam turbine. It is found in all such cases that a large portion of the heat energy (60 to 90%) cannot be converted, but remains as heat, while the remainder is turned into mechanical energy, and possibly later (by means of a generator) into electrical energy.

A gas engine of 25% efficiency uses fuel enough to supply 1,535,000 B.t.u. The engine is "direct connected" to a 120-volt d.c. generator of 80% efficiency. How many kw-hrs. does the generator give out, and what is the average current, if the fuel is burned in 5 hours?

The energy in the fuel = 1,535,000 B.t.u.; $1,535,000 \div 3,412 = 450$ kw-hrs.; 25% of this = 112.5 kw-hrs. which the engine gives to the generator. Then 80% of 112.5 = 90 kw-hrs. which the generator gives out. If this is given in 5 hours, the average power is $90 \div 5 = 18$ kw. = 18,000 watts. Current = watts/volts = $18,000/120 = 150$ amperes.

Tests show that it requires only about .02 of a B.t.u. to heat one cubic foot of air one degree. What is the cost of warming a room $12 \times 15 \times 9$ ft. from 30° to 65° F. by electricity costing 6 cents per kw-hr.? The cubic feet = 1620, which could be warmed 1° by 32.4 B.t.u. Heat required = $35 \times 32.4 = 1133$ B.t.u. which equals $1133/3412 = .33$ kw-hrs. Hence the cost is 2 cents.

Solutions of Problems of Previous Set

61. $30/15 = 2$ amperes = current; hence loop resistance is 9 ohms, and each wire has 4.5 ohms. The load takes 60 watts; line loss = $2 \times 2 \times 9 = 36$ watts. Power delivered by battery = 96 watts, and efficiency of line = $60/96 = 62.5\%$.

62. $15 \times 2.6 = 39$ volts drop. Watt loss = $39 \times 15 = 585$ watts. $110 - 39 = 71$; $71 \times 15 = 1065$ watts in arc.

63. When 30 volts are applied the total current is 10 amperes; that through the heater is 2.5 amperes. Resistance of coil = $30/7.5 = 4$ ohms. Power taken = 300 watts.

64. Loss = amperes \times amperes \times ohms = $14 \times 14 \times .56 = 110$ watts.

65. Loss in "armature" = 10 watts, 40 watts, and 90 watts in the three cases. Loss in "field" = 64 watts.

66. Input = volts \times total amperes = $32 \times 22 = 704$ watts; output = input — losses = $704 - 40 - 64 - 150 = 450$ watts; efficiency = 64%.

67. The total resistance = $50 + 165 + 9 = 224$ ohms; current through transmitter = .116 ampere. Current in one winding = $.116/2 = .058$ ampere; power = $.058 \times .058 \times 18 = .06$ watt.

68. Lamp resistance = $111.2/7.2 = 15.44$ ohms. Adding line resistance (between generator and lamps) makes the total circuit resistance = 15.7, hence the current = $116.7/15.7 = 7.44$ amperes. Drop in line = $7.44 \times .26 = 1.93$ volts,

leaving 114.8 volts at lamps. Line loss = $1.93 \times 7.44 = 14.4$ watts.

69. The heater loop has $50 \times .002 = .1$ ohm, so that this branch has a total of 1.2 ohms. The combined resistance of the two branches is found by assuming one volt across JK: $1/1.2 = .8333$; $1/6 = .1667$; sum = 1.000 ampere: hence combined resistance = $1 \div 1 = 1$ ohm. Add the resistance of the other loop ($100 \times .002 = .2$ ohm) and total circuit resistance = 1.2 ohms.

70. Current from battery = $30/1.2 = 25$ amperes = current in the 50 ft. wires; drop = $.2 \times 25 = 5$ volts, leaving 25 volts at junction. Current through heater loop = $25/1.2 = 20.82$ amperes. Drop = $20.82 \times .1 = 2.08$ volts; at heater voltage = $25 - 2.08 = 22.92$ volts. Loss in each 50 ft. wire = volts drop \times current = $2.5 \times 25 = 62.5$ watts; in each 25 ft. wire loss = $1.04 \times 20.82 = 21.6$ watts.

71. $30,000/550 = 54.5$ hp.

72. Speed = $15 \times 5380/2600 = 22$ ft. per sec. Then $500 \times 22/550 = 20$ hp. $3/4$ of 20 = 15 kw. = 15,000 watts.

73. Since No. hp. = lbs. \times ft./($550 \times$ secs.), the lbs. = hp. \times 550 \times secs./ft. = $26 \times 550 \times 300/110 = 39,000$. Gallons = $39,000/8.3 = 4700$.

74. The input to pump = $26/.65 = 40$ hp. The input to the motor = $40/.86 = 46.5$ hp. = 35 kw.

75. Input to motor = $4/3$ of 30 = 40 hp. Output = $40 \times .90 = 36$ hp. Only 86% is applied to cages: $36 \times .86 = 31$ hp.

76. The cages constitute a net load of $3300 - 1600 = 1700$ lbs. Since hp. = force \times speed/550, speed = $550 \times$ hp./force = $550 \times 31/1700 = 10$ ft. per sec.

77. Output of locomotive = $1200 \times .5 \times 5280/(550 \times 3600) = 16$ hp. = 12 kw. Input = $12/.65 = 18.5$ kw. Amperes = $18500/84 = 220$ amperes.

Problems on Energy Transformation

78. A motor of 92% efficiency, with an input of 250 hp., drives a mine pump which lifts 1000 gallons per minute to a height of 660 ft. Find efficiency of pump.

79. The resistance of the loop between a generator and a motor is 3 ohms (total). The motor input is 5700 watts; the generator delivers 6 kw. to the line. Find line loss and current flowing.

80. What is the hp. output of a gas engine which has 32% efficiency, if it uses in 20 hours fuel enough to produce 2,300,000 B.t.u.?

81. A 100-hp. motor of 90% efficiency drives a ventilating blower 8 hours at a cost for current of \$14.60. What is the price of electric energy?

82. How many B.t.u. per hour are developed by an electric hot plate taking 4 amperes on a 220-volt circuit? If half the heat escapes to the air how hot will 8 lbs. of water get in half an hour, if its temperature is 60° when set upon the hot plate?

83. How many gallons of cooling water per hour will be warmed from 60 to 100° Fahr. in a 1000-kw. transformer of 97% efficiency,

84. A 35-hp. motor hauls a loaded car at 3.5 ft. per second up a 40° slope to a coal bunker. Find the weight of the loaded car, the pull being 70% of the weight.

85. With a motor of 60% efficiency, how many ft. lbs. of work will be done on \$4.50 worth of energy at 5 cents per kw-hr.?

86. A 600-watt electric heater operates for ten minutes in a bath room $6 \times 8 \times 8$ feet in size. The air is at 50° Fahr. at the beginning; what is its final temperature if all the heat remains in the air?



INCANDESCENT LAMPS were invented in 1879. If you need more light on the subject of supplies

THE SEARCHLIGHT SECTION IS AT YOUR SERVICE

Advertising

BY HOWARD ANGUS

(The stranger in the city is not on your mailing list, and perhaps does not see the newspaper; how can you introduce your store to him? In this concluding article of his series on advertising, the secretary of the California Electrical Cooperative Campaign discusses sign advertising and store display as publicity methods.—The Editor.)

Those among you who are large electrical contractors and dealers can use bill boards with good effect. This means of advertising is probably too expensive for the average electrical contractor and dealer, even though it is effective. It is quite possible, however, for all electrical contractors and

possible have the body of your delivery wagon in some unusual design. That always attracts attention and interest.

An electrical contractor should always have a sign on every house he is wiring, telling those who pass his firm name, store address and telephone number.

Electric Signs

You should by all means have an electric sign. For you not to have an electric sign is the same thing as an automobile man without an automobile, a grocer refusing to eat, or a clothing merchant not wearing clothes. An electric sign typifies your business so perfectly that it is a necessity and should set the example for the city.

An electric sign is of great advertising value. While it is difficult to estimate the number of people an electric sign will bring to your store, all of them have always resulted in more sales. The big advantage of the electric sign is its appeal to people at night. The streets are always filled with people in the evening who are either shopping, going to or from some entertainment or otherwise on pleasure bent. At this time their minds are relaxed and they are in a receptive mood and particularly impressionable. The four features of an electric sign, generally speaking, are: motion, color, uniqueness and a message. An electric sign always receives attention and arouses interest, but to awaken a desire and action it must tell a story briefly by picture or word, preferably both.

Store Display

Your store display is part of your advertising. Your appliances neatly and temptingly arranged in show cases, on the display tables and on the floor, your fixture room—all should call the attention of any person in your store to other articles in such a manner as to awaken their attention and interest. The subject of store display is too large to be even attempted in this article. It is mentioned, however, that you may understand that there are reasons for an attractive, clean and neat store display and that one of those reasons is advertising and selling value.

There should be unity in all your advertising. Your windows should show what you have advertised in the newspapers or on the billboards or in the street cars or sent out in circular letters, and all should tie-in with the advertising of your manufacturers in the national magazines.

Civic Interest

Any activity on your part in assisting your city to grow will help your business.

Every merchant in every city should be interested and take an active part in all organizations and movements that have for their purpose the growth



The billboard shown above was most successful in attracting the attention of the unobservant crowd to the recent San Francisco electrical home.

dealers in any city to band together and use billboards effectively. This will sell the electrical idea in a cooperative manner and will indirectly secure results to the individual contractor and dealer.

The Use of Billboards

The most important feature of a billboard is its location, for again it is readers you are after. The ideal location of course is on some principal highway leading into the city over which there is a great deal of traffic, preferably on a curve, so that the sign faces the people as they come up the road. The same principles apply to a good billboard as to a newspaper advertisement with the addition that it should have striking and distinctive colors and a unique appearance. A billboard, especially one owned by an electrical contractor-dealer, should be illuminated at night, not only for the advertising value of the board during the dark hours but also to sell illumination to the public.

What has been said of billboard advertising applies equally to street car posters.

A fine medium of advertising is your delivery wagon. These should all carry advertisements telling what you have to sell, how desirable it is, and where your store is. These statements should be short and to the point and in extra large letters, because delivery wagons pass rapidly. You ought to have several signs and change them frequently, because you have more than one article to sell. If

and development of his city. This work has a very definite effect on his store. First, the larger his city becomes the more business there will be for him to do, and secondly, it has a distinct advertising feature. The more he moves and works among his fellow men, the better known he becomes. The more intimately his activities become connected with those tending to make the city grow and become prosperous, the more often his name appears in the newspaper and the more people come to know of him by reputation. This advertising is of the highest value, for people think of their prominent men as reliable and worthy of confidence. The certain result is more business for the store. A study of the leading merchants of your city will convince you of this fact.

And what is good business for them, is good business for you. Many contractors and dealers have realized that important fact. More should. It will help you to help your city become bigger and better and to associate yourself with its leaders.

The electrical industry must be a unit in telling the electrical story to the public, just as other industries are. The manufacturers are telling the story to the entire United States; the power companies are telling it throughout their territories. The story will not be perfectly told unless the contractor-dealers tell it in their city—which is their particular territory. That you may know how to raise your advertising voice and make it blend with the whole, these articles have been written.

The Starting of a Gold Dredge

(That the West is leading in the practice of electric welding and that the average citizen of this section of the country is taking an ever-increasing interest in the industrial progress made possible by electricity is shown in this account of the starting of an electrically operated gold dredge of the latest type in Gold Canyon, Nevada.—The Editor.)

On the fifth of September the people of Nevada celebrated the beginning of a new chapter in the famous story of the Comstock district. Since the days of the Civil War this section of the West has been a leader in the production of gold and silver, but now through the application of electric power a still greater yield is being made possible.

The construction of a \$350,000 steel gold dredge in Gold Canyon is the beginning of a program of development which is being planned by the Bulkeley

engineer for the Wells enterprises said, "Nothing has been left off." He was especially proud to state that the dredge contains every known device for the safety of operatives. Enclosed safety switches are used throughout.

The Electrically Welded Deck

The feature of this dredge, as far as the electrical industry is concerned, is the electrically welded deck. The plates of the 108 by 46 foot deck are



From every direction cars found their way to the gold dredge which stood alone in the hollow of the desert ready to start its laborious tour over the valley. Slowly but surely, working day and night, it will eventually reap the gold which lies in the surface ground of the surrounding seven hundred acres.



A side view of the steel gold dredge is shown above. At the extreme left may be seen the apparatus which supports the line of buckets which scoop the gravel and sand from the front of the pond. The leg-like spuds are seen to the right of the house portion and the stacker from which the waste is dumped is extending to the rear.

Wells interests. A company known as the Gold Canyon Dredging Company has been formed and this is directly responsible for the dredging enterprise. The company has acquired 700 acres of ground in the valley and has reason to believe that this kind of placer mining will yield most satisfactory returns.

As shown in the picture above, over 2,000 prominent citizens from various parts of the state of Nevada gathered to witness the starting of this modern steel dredge and to commemorate this beginning of a new era in the gold-mining industry of the state.

This Gold Canyon dredge is not a giant in size, but it is one of the most complete and finished products ever floated. As Edwin Higgins, consulting

1/4-inch thick and were placed with a 1/4-inch opening between all edges, thus providing space for welding. This made a perfectly smooth deck in noticeable contrast to the riveted deck. Two 10-kilowatt generator sets transformed the a.c. current from the line to 60-volt d.c. current which was used for welding. Two men welded the entire deck in three weeks and although the actual time spent on the job was as long and perhaps longer than riveting would have

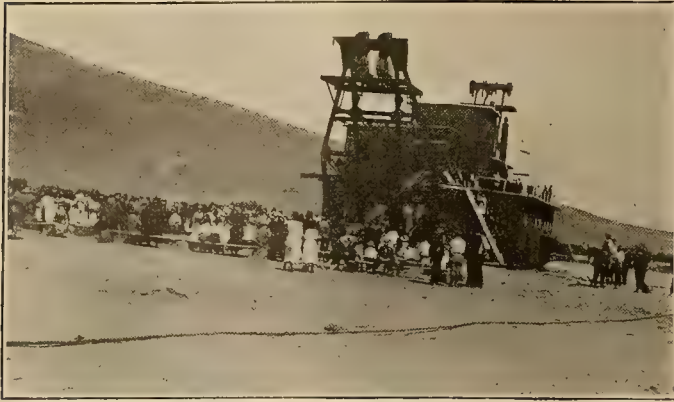


ELECTRIC WELDING was invented by Thomson in 1889. All is not useless that was broken; if you can't afford a new one

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required, the time necessary in preparing rivet plates and rivets away from the job throws the balance distinctly on the side of electric welding.

George L. Hurst of the Bethlehem Shipbuilding Corp., Ltd., who designed the dredge, strongly advocated that it be entirely welded by electricity, but



Showing some of the many visitors who gathered to witness the ceremonies held in connection with the throwing of the switch which put the dredge in operation.

because this practice was new and untried others in authority did not feel safe in taking such an advance step. This one trial, however, has proved the superiority of the electric welding practice and a large California dredge, to be entirely welded by electricity, is now being planned.

Electricity and Operation —

The power used in operating this dredge is taken from Truckee River Light and Power Company lines at 4,400 volts and is carried to the dredge over a 1,500-foot cable where it is transformed to the 440-volt current used in operating the motors. The dredge has a 500-hp. load. The largest motor is 200-hp., used to operate the bucket line that scoops the gold-laden gravel from surface to bedrock and carries it up to the top of the dredge, where it is dumped into an inclined revolving grizzly and washed by a stream of water passing in the opposite direction. After the material has gone through the screen, the waste is carried up to the end of the stacker by means of a motor and is dumped behind.

As it clears a way before it this boat-like mill moves forward by means of two spuds which might be likened to two huge legs. Two 50-hp. motors control these spuds. While the boat is turned sideways one free spud is lifted and moved forward; when the next move is made the dredge is held on this forward spud while the other one is released. Thus the floating mill moves through the desert valley leaving a path of mined material behind it. In all nine motors are needed to operate the dredge.

Opening Ceremonies —

The fact that the people of Nevada considered the starting of this dredge an occasion worthy of their consideration is significant in showing how the average citizen of the West is coming to realize what electric power is doing constantly to build up the industries upon which the prosperity of their state depends. Gerald H. Hutton, general manager of the dredge, under whose supervision the boat was built in the record-breaking time of less than six months,

was master of ceremonies. Mr. Higgins of the Bulkeley Wells Company was the first speaker. He gave a brief history of placer mining from the first days of the gold pan to the present days of the electrically operated steel dredge.

This speaker was followed by Dr. Walter E. Clark, president of the University of Nevada, and then by Dr. Aurelia Henry Reinhardt, president of Mills College, both of whom emphasized the necessity of higher education in preparing the men and women of the future to carry on the great industrial development possible in the West. The concluding address was delivered by Governor Emmet D. Boyle of Nevada, who touched briefly upon the difficulties that beset the men undertaking this big enterprise and of the large investment required. He empha-



A view of the line of buckets which scoop the gold-laden gravel and lift it to the top of the mill. Each bucket weighs 200 lbs. and holds nine cubic feet of gravel. They are made of manganese steel. The buckets are dumped at about the rate of 20 per minute.

sized the fact that this huge piece of complicated machinery was powerless to accomplish the things for which it was designed without the aid of electric power brought many miles over the mountains from where it was generated by the waters of the Truckee River.

After the cheering which followed the Governor's address, Mrs. Boyle threw the switch that started the machinery and the guests were permitted to view the dredge in operation.

ELECTRIFICATION OF RAILROADS IN JAPAN

The Japanese railway authorities have decided to substitute electricity for steam on all lines within the empire, according to recent reports to the Department of Commerce. The change, which it is estimated will cost 200,000,000 yen, is expected to reduce the number of locomotives in service by 40 per cent.

SPARKS—Current Facts, Figures and Fancy

(A glance at this page will assure you that there is no need to worry further about labor shortage, a dearth of fuel oil or the danger of observing the enemy camp by airplane. Significant facts concerning the interior decoration of tunnels, the value of daylight saving and another world's record for the West also appear.—The Editor.)

Why speak of labor shortage when enough hydro-electric energy is running to waste in the West to equal the daily labor of 1,220,400,000 men?

* * *

A total of 571 disabled ex-service men are taking courses in electrical engineering at the expense of the Federal Board for Vocational Education.

* * *

Western ports are encouragingly busy but even so we must still consider New York. She is still somewhat in the lead with a train arriving every 52 seconds and a ship leaving the harbor every 48 minutes.

* * *

We are pretty well wired up in this United States, considering that there are ten miles of telephone wire to every one square mile of territory. Some day wireless telephony may be a matter of necessity.

* * *

We have before mentioned the fact that San Franciscans are record-breaking talkers and now are prepared to announce that this city claims the largest telephone terminal rack in the world. This frame has about 250,000 connections.

* * *

The interior decoration of tunnels will be greatly improved and simplified by the use of a newly invented piece of machinery which sprays concrete on the interior of tunnels and almost immediately smooths it in place with swinging arms.

* * *

Brazil can see no reason for steam railroads in a country abounding in hydroelectric possibilities, so she has appropriated some eleven million dollars to cover the cost of changing a part of the railroad system surrounding Rio de Janeiro from steam to electricity.

* * *

The United States is sending 207 carloads of electrical equipment to India for the establishment of two large central stations, 90 miles inland from Bombay. The total weight of the shipment is 80,000 tons and some of the heaviest lifts between Bombay and the destination will be made by means of elephants.

* * *

Wartime flying may be a bit unsafe but why not keep the pilot safe on earth? Such is the theory of a prominent British mechanical engineer who announces that he can control his crewless aerial torpedo thousands of miles away. The torpedo can be used for photography, exploration, observation or carrying mails.

Can you suggest an easier way of saving twenty million dollars than setting your watch ahead an hour? During the seven summer months this amount was saved in our country under daylight saving. And then, as they say we are running short of coal, it is pleasing to note that 300,000 tons of this material were saved by the same process.

* * *

The four leading producers of tungsten ore are Western states, as are the leaders in the output of gold, silver, and precious stones. California, Colorado, Nevada and South Dakota lead in the production of tungsten ore, California, Colorado, Alaska and Nevada in gold, and Montana, Nevada, California and Arizona in the production of precious stones.

* * *

The United States produces two-thirds of the world's oil supply, but even at that consumes more than she can produce. There is comfort in the fact that Mexico, our next-door neighbor, has the greatest demonstrated supply in the world. If all the wells now drilled in Mexico were allowed to flow unrestrained, they would produce from 1,500,000 to 1,900,000 barrels daily.

* * *

Those of us who are attracted by the rubber pavement idea are glad to hear that it is being seriously tried out on a large scale. Half only of the road in a certain part of England is being surfaced with rubber, so as to afford a comparison in efficiency. This new material is being laid in flat slabs three-fourths of an inch in thickness, attached to steel plates, from which project broadly-flanged studs which are gripped by the concrete foundation.

* * *

After all, it seems that mountains and dashing rivers are not essential to hydroelectric development. It is reported that the French are considering the ocean as a profitable substitute. The scheme planned depends on the construction of four basins at different levels at the mouth of the River Rance. Each basin will be used for power generation at different states of the tide. They will have an aggregate area of some 50,000 acres, and it is estimated that turbines worked by the passage of water into and out of these basins will give 5,000 hp. at neap tide and ten times more at spring tide.



RADIUM was discovered by M. and Mme. Curie in 1898. All discoveries are not accidental. Look for what you want:

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Difficulties in Hydro-Electric Exploration

Photos by W. L. Huber



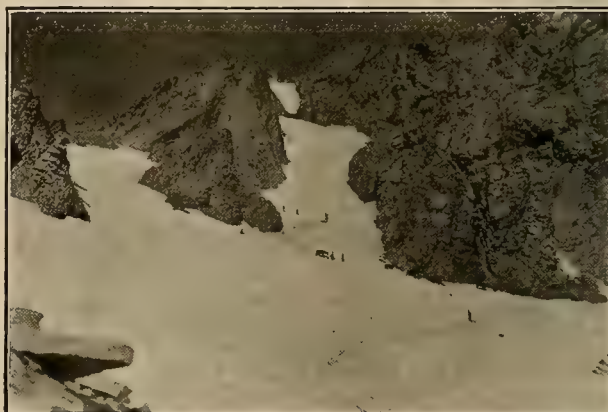
Looking south from Kearsage Pass in late July, elevation 11,823 ft. The upper reaches of the Sierras are full of small glacial lakes which are important factors in any drainage area being considered for hydroelectric development. Many of these are far away from trails and frequently overlooked by any but the aviator.



Engineer descending the wall of Little Canyon, Arizona. This gives some idea of the difficulties encountered in obtaining data in country which is not even accessible on horseback. A surveying trip involving many weeks in the field is not only an expensive undertaking, but often one fraught with considerable danger.



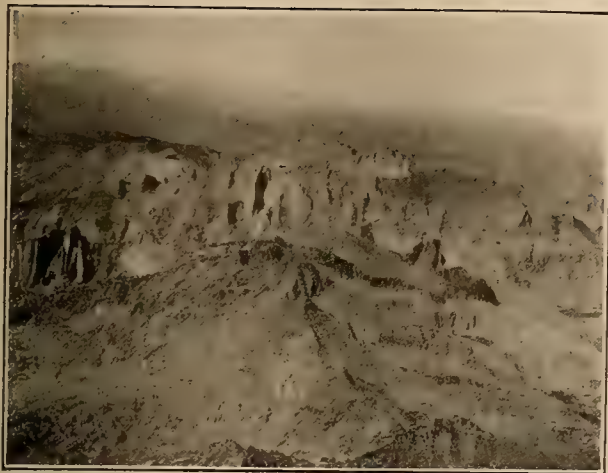
Preparing a report to the chief engineer, 100 miles from the nearest railroad, on the Painted Desert. The Corona and the Ford as modern equipment for desert surveying parties have solved some problems of time and labor, but over regions where even the Ford cannot go the airplane and the camera pass, registering every topographical detail necessary for making development plans.



Descent from Shepherd Pass, elevation 12,000 feet, between Kern and Owens River drainages, on Owens Valley side. Days of travel with a pack train are often required to cross passes of this kind, whereas an airplane can inspect the area in a few hours, and collect valuable data on precipitation and run-off at seasons when the depth of the snow makes it absolutely impassable for horseman or foot-traveler.

Simplified by the Use of the Airplane

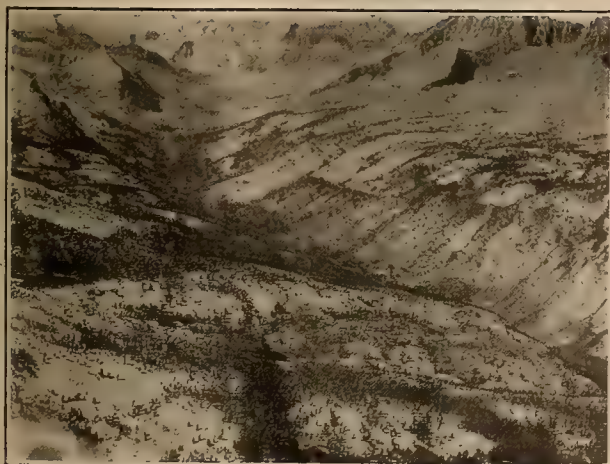
Photos by 15th Aerial Photographic Section,
Air Service, U. S. Army. Copyright.



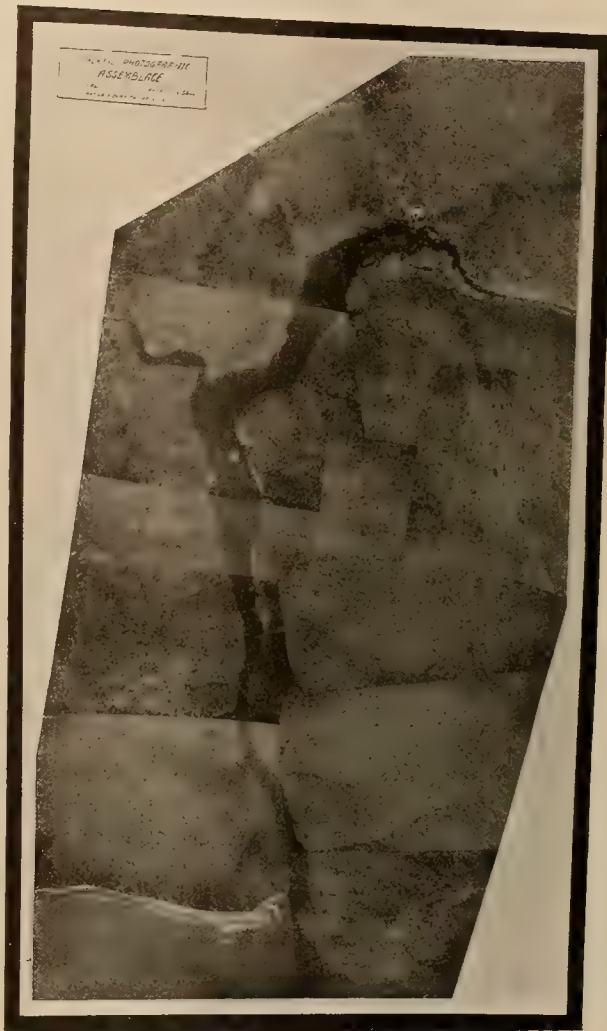
Panoramic view of peaks in the vicinity of Mt. Whitney



Cinder Cone and lava beds near Mt. Lassen



An upper drainage in the Kings-Kern country



Mosaic of Kerckhoff project

The photographs on this page serve to illustrate the completeness of the topographical and precipitation data to be obtained through the use of the airplane, which can cover in a few hours territory which would occupy a surveying party for weeks.

Of special interest is the large mosaic showing the San Joaquin Company's Kerckhoff dam and the power house above, one of the first hydroelectric undertakings to be mapped in this way. The picture is published in connection with the article by R. C. Starr, construction engineer for the company, which appears on page 357 of this issue. Mr. Starr gives complete data on the methods employed in making aerial surveys of hydroelectric projects and the successful results achieved.

The characteristics of a drainage area vary very widely with its elevation, exposure, timber and so forth. All these factors must be accurately determined before the capacity and details of the project can be decided upon. This data can be collected with greater speed and accuracy by means of aerial photographs than by any other method.

PERSONALS

George Kidd, general manager of the British Columbia Electric Railway Company, Ltd., is chairman of the Advisory



Committee of the British Columbia Cooperative Association recently launched at Vancouver, B. C., at an enthusiastic get-together meeting which brought out practically every contractor-dealer in the entire British Columbia district. Plans for a constructive program of merchandising improvement were outlined at this time which set a bogey of quadrupling present sales and the general good feeling within the industry was even more firmly cemented. The Electric Railway Company, under the progressive direction of Mr. Kidd, has taken a leading part in this movement, which has been cordially supported by all branches of the industry. Other members of the advisory committee include J. R. Read, district manager, Canadian Westinghouse Company; R. F. Hayward, general manager Western Power Company of Canada; H. Pim, district manager Canadian General Electric Company; J. F. Little, district manager Northern Electric Company; W. G. Murrin, assistant general manager, E. E. Walker, sales engineer, and James Lightbody, publicity manager of the British Columbia Electric Railway Company; W. W. Fraser, E. Brettell and S. E. Jarvis, Vancouver dealers, and F. T. Cope, a Vancouver jobber, all of whom were speakers at the recent meeting.

Robert Sibley, editor of the Journal of Electricity, has been appointed chairman of the Publicity Committee of the Pacific Coast Division, N. E. L. A.

Herbert Hoover has been appointed by Secretary Payne as consulting engineer of the advisory board of the eastern industrial region super-power survey now being made by the Geological Survey.

Vernon Kellogg, professor of entomology, Stanford University, and permanent secretary of the National Research Council, has been elected chairman of the Division of Educational Relations of that Council.

C. H. Payne, assistant chief electrician of the Western Light and Power Company at Boulder, Colorado, has resigned his position and with his father, W. E. Payne, will enter business in Florida. Mr. Payne has been in the employ of the company for ten years.

W. C. Smith, of the transformer department of the General Electric Company, with headquarters at San Francisco, will spend some weeks in the eastern centers during the coming two months, the major portion of which time will be spent at Schenectady, New York.

John C. Merriam, formerly professor of palaeontology University of California, and president-elect of the Carnegie Institution of Washington, has been elected chairman of the Division of States Relations of the National Research Council, with headquarters at Washington, D. C.

Ernest Fox Nichols, recently professor of physics at Yale University and formerly president of Dartmouth College, has accepted an invitation to assume the immediate direction of the Laboratory of Pure Science of the Nela Research Laboratories conducted by the National Lamp Works of the General Electric Company at Nela Park, Cleveland, Ohio.

D. F. McCurrach, formerly assistant engineer with the Public Service Commission of Washington, has been employed for several months past by the Pacific Power & Light Company as consulting engineer, to examine into electric operations in Washington in connection with application for increased rates.

George J. Wheat, formerly assistant superintendent of the Alameda County district of the Pacific Gas & Electric Company, is now general manager of the Wheat Electric Company, electrical contractors and dealers of Santa Maria, California, where he is engaged in the installing of irrigation pumps and a number of motors in the oil fields, in addition to the merchandising of electrical ware.

John Barrett, director-general of the Pan-American Union, has retired from that position after fourteen years of service. He is succeeded in this position by Dr. L. F. Rowe, who has worked with him for a great number of years. Mr. Barrett retires to private life to establish connections throughout the United States and the Pan-American countries to act as general counselor and adviser in Pan-American and other international affairs.

Irene Warren, librarian, Globe-Wernicke Company, Chicago, and well known to readers of the Journal of Electricity as author of the series of articles on Office Records—Their Filing and Indexing, has been appointed as one of a special Committee of Methods to collect, with a view to publication, from all types of special libraries throughout the country, data in regard to various methods used in these types of libraries, such as subject heading, classification, circulation and routing, literature and library publicity.

F. B. Lewis, superintendent for Southern California Edison Company, left for New York on Sept. 21 to attend the meetings of the Accident Prevention Committee of the National Electric Light Association to be held there Oct. 4 and 5. Mr. Lewis represents the Pacific Coast Section on this committee. On his return trip he will attend the meeting of the Safety Rules Committee and also the Underground System Committee, both of which will be held in Chicago. The time intervening between the two meetings will be devoted to visiting important manufacturing centers.

Carl C. Thomas, professor in mechanical engineering at Johns Hopkins University, has been elected to the Board

of Managers, American Society of Mechanical Engineers. Mr. Thomas studied at Stanford University and is a graduate of Cornell University from the college of mechanical engineering, and after graduation in 1895 entered the employ of the Globe Iron Works, shipbuilders of Cleveland, Ohio. Some time later he worked for Moran Brothers, shipbuilders of Seattle, Washington, and then accepted a position as professor of



marine engineering at Cornell University. Mr. Thomas was connected later with the University of Wisconsin and the University of California as instructor in thermodynamics, leaving that position to organize the newly formed department of mechanical engineering at Johns Hopkins University in 1913. During the war Mr. Thomas was connected with the American International Shipbuilding Corporation and is now located in Los Angeles as Western representative for Dwight P. Robinson and Company, Inc., Engineers, which have recently become consolidated with Westinghouse, Church, Kerr & Company, Inc., New York City. He has been very active in A. S. M. E. affairs and is the author of a book on steam turbines.

Charles H. Tallant, formerly advertising manager of the Pelton Water Wheel Company, has accepted a position with the McGraw-Hill Company as manager of the Service Department of the San Francisco office. Mr. Tallant is a graduate of Stanford University with the class of 1911 from the college of electrical engineering, and until 1916 was connected with the advertising and dealer service department of the San Francisco office of the General Electric Company. He then became advertising manager of Western Engineering,



which position he held until the outbreak of the war when he joined the Grizzlies and at the conclusion of the war held the rank of second lieutenant. Mr. Tallant then became associated with the Pelton Water Wheel Company which position he held until joining the McGraw-Hill Company. The inauguration of the service department in San Francisco is only one of the ways by means of which the McGraw-Hill Company tries to render to its patrons the greatest possible service. Mr. Tallant was chosen to fill this position as he possesses those capabilities which make for increased efficiency within the organization and increased friendship for all that come in contact with the organization.

F. W. Mills, chief electrical engineer of the South African State Railway, is making a tour of the West.

R. G. Swan, hydraulic engineer of the Dominion Water Power Department of Canada, is among recent San Francisco visitors.

W. M. States, manager of the International General Electric Company at Shanghai, passed through San Francisco on his way to Schenectady.

F. G. Sykes, vice-president of the American Power & Light Company of New York, visited the various offices of the Pacific Power & Light Company recently, going to Wichita, Kansas, from here.

R. N. Buell, formerly a consulting engineer of San Francisco, now doing installation work in Melbourne, has installed the first unit of a power plant to burn pulverized lignite under boilers in Australia.

R. E. Frickey, formerly electrical engineer for the Northern California Power Company, is now consulting electro-welding engineer for the Moore Shipbuilding Company with headquarters in Oakland, California.

A. E. Morphy, secretary of the Southern California Edison Company, is making an extended trip in the East, his itinerary including the convention of the Association of Edison Illuminating Companies in New London, Conn.

W. C. Chappell, electrical engineer, the Electrical Commission, Melbourne, Australia, stopped in San Francisco the first of this week en route East. He expects to return to San Francisco and make a longer visit within a few weeks.

E. A. Palmer, engineer in the railway department of the San Francisco office of the Westinghouse Electric & Manufacturing Company, has gone East to Atlantic City, New Jersey, to attend the American Electric Railway Conference which is being held in that city.

R. F. Hayward has resigned as general manager of the Western Power Company of Canada, Ltd., Vancouver, B. C., and leaves at the end of October for Santiago, Chili, to become manager of the Santiago Light, Tramway & Power Company. Mr. Hayward came to Vancouver from England and has been connected with the company for the past eleven years.

Max Thelen, author of the California Public Utilities Act and former president of the California Railroad Commission, has resigned his position as chief of the liquidations and claims department of the United States Railroad Administration and will return to California to resume the practice of law.

Arnold J. Noerager, chief electrical engineer, Braden Copper Company, Rancagua, Chile, has been visiting in San Francisco for the past few weeks. Mr. Noerager is well known in San Francisco due to his employment in that city by the General Electric Company before going to South America.

W. R. Dunbar, supply salesman in the San Francisco office of the Westinghouse Electric & Manufacturing Company, has recently left for a trip through the East where he will visit the Westinghouse plants at South Bend, Indiana, Mansfield, Ohio, East Pittsburgh, Pennsylvania, and Brooklyn, New York.

E. O. Shreve, local manager of the General Electric Company and president of the San Francisco Electrical Development League, is spending six weeks in eastern business centers. **A. V. Thompson**, head of the railway department of the San Francisco office of the General Electric Company, accompanied Mr. Shreve East.

E. W. Dichman of the McCook Field, Dayton, Ohio, has been a visitor in San Francisco and Los Angeles for the past several weeks. Mr. Dichman is a graduate of the electrical engineering course at the University of California with the class of 1914 and contributes a very interesting article in this issue on Airplane Costs in Hydroelectric Work.

J. P. Jollyman, engineer of electrical construction, Pacific Gas & Electric Company, has been elected chairman of the San Francisco chapter of the American Institute of Electrical Engineers for the coming year. Mr. Jollyman is a graduate of Leland Stanford Junior University in the college of electrical engineering with the class of 1903. After graduation he went to work for the California Gas & Electric Corporation which later became the Pacific Gas & Electric Company remaining until 1909 when he accepted a position with the



Great Western Power Company which at that time was just completing the work on the Big Bend power house. Mr. Jollyman was in charge of the power house and the changing over of the transmission line from 60,000 volts to 100,000 volts. In 1911 he returned to the Pacific Gas & Electric Company as engineer of electrical construction, which position he now holds. Mr. Jollyman had charge of the designing of the electrical and hydraulic installations at Drum Power House, Halsey Power House, Spaulding Power House, and Wise Power House which has the largest single discharge turbine in the world. He is considered one of the best electrical construction engineers in the West and is responsible for the great interconnections on the Pacific Gas & Electric Company's system.



TYPEWRITERS were invented by Sholes in 1878. If you want to exchange your fountain pen for one,

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Meeting Notices for Electrical Men

(That the electrical men of Portland are approaching the ideal of cooperation is shown in the report of a recent A. I. E. E. and N. E. L. A. meeting which appears on the following pages. The new officers of the Colorado Electric Light, Power and Railway Association, an account of engineers' activities in Utah, the launching of a cooperative association in British Columbia and an account of the annual dinner of the Seattle Section A. I. E. E. are among the notices of the important meetings which have occurred during the past two weeks.—The Editor.)

Portland A. I. E. E. and N. E. L. A. Inaugurate New Policy on Meetings

Association activities in Portland started for the year with a big get-together meeting September 28, with a good program and specialties in the way of entertainment. Over seventy were present. A. C. McMicken, sales manager Portland Railway, Light & Power Company, addressed the meeting on "The Cooperative Movement in the Northwest," and Miss Clotilde Grunsky, associate editor of the Journal of Electricity, outlined the work of the California Cooperative Campaign.

For several years past the Portland sections of the A. I. E. E. and the N. E. L. A. have been holding joint meetings, and this year it has been decided to grant the request of the Portland section of the Oregon Association of Electrical Contractors and Dealers to meet jointly each month with these combined sections. Under the old arrangement it was possible to secure better speakers than either society alone could secure, and to have refreshments and cigars each meeting, which proved a big drawing card. The new arrangement will make possible even bigger and better meetings than before. The contractors and dealers have asked to bear their proper proportion of the expense of conducting the meetings and occasionally will have a program of particular interest to them.

The officers of the three sections and the personnel of the various committees have been chosen with a view to getting real results, and it is expected that this year will be the most successful in the history of local association activities. For the A. I. E. E., E. F. Whitney is chairman and W. C. Heston secretary; N. E. L. A., A. D. Leach, chairman, W. A. Dunlap, secretary; Contractor-Dealers, F. A. Bauman, chairman, F. R. Whitteley, secretary.

New Officers and Committees of Colorado Association

On the occasion of the seventeenth annual convention of the Colorado Electric Light, Power and Railway Association at Glenwood Springs, Colo., September 13, 14 and 15, when C. A. Semrad, Boulder, general manager of the Western Light & Power Company, was elected president, T. O. Kennedy, Denver, general superintendent Denver Gas & Electric Light Company, first vice-president, and Fred Norcross, Greeley, manager Home Gas & Electric Company, second vice-president, the new Executive Committee personnel was made as follows:

W. J. Barker, vice-president and general manager Denver Gas & Electric Company; W. F. Brown, Mountain States Telephone & Telegraph Company; Norman Reed, manager Colorado Power Company; W. C. Sterne, manager Ft. Lupton Light & Power Company; E. A. Phinney, manager Jefferson County Light, Heat & Power Company.

Advisory Committee:

J. F. Dostal, manager Colorado Springs Light, Heat & Power Company; W. F. Raber, manager Arkansas Valley Railway & Light Company; D. A. Hegerty, vice-president and general manager Western Light & Power Company; J. A. Clay, manager Western Colorado Power Company; W. P. Southard, manager Trinidad Light, Heat, Railway & Transmission Company.

The Colorado Association has always been an active state association, and it is not proposed to lose its identity with the creation of a geographical N. E. L. A. Division, mainly because the Colorado Association embraces not only electric light and power utilities but also street railway, gas and telephone utilities. It is planned to have the closest cooperation between the state association and the Geographical Division so as to avoid duplication of effort.

Oregon Contractors to Meet

The state convention of the Oregon Association of Electrical Contractors and Dealers will be held in Portland October 15 and 16.

Utah Engineers Propose Development of State Waters

The Utah Society of Engineers, Salt Lake City, at a recent meeting went on record as in favor of the vigorous prosecution of a plan for the development of arid lands, the use of flood waters and the further development of irrigation in Utah in general, as outlined by A. F. Parker, chief engineer of the Utah Water Storage Association. Mr. Parker presented a preliminary tentative draft of a

bill which it is expected will be brought in some form before the next Utah legislature. The bill would create a state development service, following the suggestion rather than the general outline of the Washington state reclamation service, and as submitted proposes development of "the latent resources and possibilities inherent in water supply, hydroelectric power, irrigation and drainage" as the declared object of the proposed legislation.

The proposed board is to consist of five directors, appointed by the Governor for five years, one director retiring each year. The directors of the service are to serve without pay, except expenses incurred. The powers and duties of the board are to make investigations necessary as the "first step looking to the ultimate full development of the agricultural resources and possibilities by outlining comprehensive plans for such development"; to adopt policies for the development of the agricultural resources, and assist in the formation of

BUILDERS OF THE WEST—LXXXVII



R. C. STARR

"The old men for counsel, but the young men for war." It was the young men of pioneer days who laid the foundations of the empire of the West—and in the tremendous strides in the building of that empire which are the work of today, young men still are in the forefront of the battle. To R. C. Starr, chief construction engineer of the San Joaquin Light & Power Corporation, who has more than one record to his credit in expeditious work on Western hydroelectric installations, this issue of the Journal of Electricity is affectionately dedicated in appreciation of that spirit of daring—that spirit of the pioneer—which he has shown in the exploration of new fields, and the use of new methods in engineering attainment.

districts; to market bonds of irrigation districts taken in payment for construction of works which may come under the jurisdiction of the board; to construct, operate or lease power plants primarily for the pumping of irrigation water; to make necessary water filings, the board being allowed first consideration and right from the state engineer; to cooperate with the United States Government in reclamation and settlement work, and to cooperate with adjoining states in development of interstate water supply.

Cooperative Association in B. C. Launched in Vancouver

The British Columbia Electrical Cooperative Association was launched on Sept. 21 at a big rally and dinner held in Vancouver, B. C. It was by far the largest gathering of electrical men ever held in Vancouver, numbering some one hundred and fifty representatives of central stations, manufacturers, jobbers and contractor-dealers. From the marked enthusiasm of the gathering the success of the movement was considered assured.

George Kidd, general manager of the British Columbia Electric Railway, was chairman. Plans of the organization were laid before the gathering showing the division of the work of the advisory council into its various branches. These departments will be handled as follows: merchandising, E. E. Walker; accounting, J. Martin; advertising, James Lightbody; store and window display, E. Brettell; architects, S. E. Jarvis and W. W. Fraser; contractors, F. T. Cope and W. C. Mainwaring.

Among the speakers were: J. R. Read, district manager, Canadian Westinghouse Company; W. G. Murrin, assistant general manager, British Columbia Electric Railway Company; R. F. Hayward, general manager, Western Power Company of Canada; H. Pim, district manager, Canadian General Electric Company; J. F. Little, district manager, Northern Electric Company; E. E. Walker, sales engineer, and James Lightbody, publicity manager, British Columbia Electric Railway Company; W. W. Fraser, E. Brettell, and S. E. Jarvis, Vancouver dealers, and F. T. Cope, a Vancouver jobber.

Figures produced set the sales bogey for greater Vancouver at \$1,570,600. This figure was made up of domestic appliances, fixtures and shades, lamps and wiring sundries, and it was estimated that of the domestic appliances only about half were being sold annually which should be sold in that time. A resolution endorsing the Association and pledging one hundred percent support was passed.

Joint Technical Societies of Los Angeles

H. A. Barre, executive engineer for the Southern California Edison Company, addressed the Joint Technical Societies of Los Angeles at a recent luncheon, taking for his subject future power possibilities in California. The speaker dwelt particularly on the program of the Edison Company which calls for the bringing in of 750,000 horsepower of hydroelectric energy during the next fifteen years. It is proposed to develop 50,000 horsepower annually during this period at a total cost of \$200,000,000. Geo. Damon officiated as chairman of the day.

San Franciscans Hear Talk on Accident Prevention

An interesting phase of the "Workings of the Workman's Compensation Law" was brought out on October 4 by Judge A. E. Graupner at the weekly meeting of the San Francisco Electrical Development League. The speaker dwelt at length on the economic necessity of preventing accidents resulting from contact with electric circuits and electrical machinery and of assisting partially incapacitated workers in getting back into their vocations and becoming self-respecting citizens again rather than objects of charity.

Judge Graupner stated that he believed 30 per cent of the industrial accidents were preventable, either by the owner, the superintendent or the employee. Last year there were over 108,000 compensative accidents in California, of which 568 were fatalities.

The scheme of rehabilitation and vocational training of the wounded was devised first by Belgium, then France, Canada and the United States. This is now being worked out in various states of the Union for industrial cases, and there is an act in force in California for industrial rehabilitation—to put the incapacitated worker back on the job.

Rocky Mountain N. E. L. A. Elects Officers

Officers elected at the first annual convention of the Rocky Mountain Division N. E. L. A., held September 13, 14 and 15 at Glenwood Springs, Colo., are as follows:

E. A. Phinney, president, Golden, Colo., Jefferson County Power & Light Company; E. P. Bacon, first vice-president, Casper, Wyo., Natrona Power Company; Arthur Praeger, second vice-president, Albuquerque, N. M., Albuquerque Gas & Electric Company; D. C. McClure, third vice-president, Denver, Colo., Denver Gas & Electric Light Company; A. C. Cornell, secretary, Denver, Colo., Western Electric Company.

Executive Committee consists of officers and:

C. M. Einhard, Roswell, N. M., Roswell Gas & Electric Company; J. A. Clay, Durango, Colo., Western Colorado Power Company; F. H. Roberts, Riverton, Wyo., Popo Agie Light & Power Company.

Section chairmen: Public Relations, Bulkeley Wells, Denver; Commercial, C. N. Stannard, Denver; Technical, T. O. Kennedy, Denver; Accounting, C. E. Twogood, Albuquerque, N. M.

Committee chairmen: Membership, C. R. Rudy, Denver; Accident Prevention, J. F. Dostal, Colorado Springs; Company Employees Organization, D. A. Hegarty, Boulder; Wiring, W. P. Southard, Trinidad.

The program of the convention was discussed in these pages on October 1.

Seattle Section A. I. E. E. Meets For Annual Dinner

The Annual Dinner and Get-Together Meeting of the Seattle Section of the A. I. E. E. was held on September 21 at the Hotel Butler in Seattle, a total of fifty members, students and visitors being present. After the dinner G. E. Quinan, chairman, spoke on the honor conferred on the Section by the election of a vice-president and introduced Dr. C. Edward Magnusson who was recently elected to that office. Dr. Magnusson stated that he intended to follow Mr. Fiskens Institute policy with which he had always agreed. He also referred to the loyalty of the members to the Seattle Section, emphasizing the fact that in most cases their own men furnished the papers presented, in contrast to the practice of some of the Eastern Sections. He thought the Section should study methods of making this district a factory and manufacturing industries center.

Mr. Quinan referred to the annual convention of the Institute which was held at White Sulphur Springs, West Virginia, last June and introduced the delegate, Willis T. Batcheller, secretary-treasurer of the Seattle Section, who made a full report of the meeting of Section delegates.

Territorial limits were referred to as of vital importance to Western Sections where the sixty-mile limit is insufficient. The Seattle Section has 150 men who are active and 15 or 20 applications under consideration. The chairman mentioned the present tendency to sectionalize the country, forming geographical divisions each with a district vice-president. He explained the tentative divisions arranged for. West of the Mississippi there were only 2,000 members out of a total of 12,000.

Electrical Supply Jobbers' Association

The Electrical Supply Jobbers' Association of the Pacific Coast will meet at Del Monte on October 21, 22, 23. Those planning to attend should communicate with Albert H. Elliot, secretary, well in advance.



MOTION PICTURE MACHINES were invented by Edison in 1889. If the family won't keep still while you use a kodak,

THE SEARCHLIGHT SECTION IS AT YOUR SERVICE

HAPPENINGS IN THE INDUSTRY

AIRPLANE USED IN LOCATING A RAILROAD

Locating a railroad by airplane has been carried out by the Third Aero Squadron, Camp Stotsenburg, Philippine Islands, according to a recent news letter of the Air Service of the United States Army. In one long flight a railroad engineer was enabled to determine the proper one of three general routes to be used for the new road. Instead of three parties of locating engineers being sent out to make the survey, it will be necessary now for only one party to go out. It is expected that many months and thousands of dollars will be saved in the work. The new line is a project of the Manila Railroad Company and an extension of its line from Cabanatuan through parts of the provinces of Nueva Ecija and Nueva Vizcaya to Bayombong.

MOUNT SHASTA POWER AUTHORIZED TO PROCEED ON PIT RIVER

Authority to proceed with the Pit River project was granted by the California Railroad Commission on Oct. 7 to the Mount Shasta Power Corporation. As part of an ultimate scheme of development of the Pacific Gas & Electric Company of approximately \$125,000,000, this project involves the construction of five or more hydroelectric plants on the Pit River, utilizing the water of the Pit between the confluence of the Fall River and the lower end of Big Bend, between which points a development of over 300,000 kw. is anticipated.

NEW OFFICERS FOR SHELLEY POWER IN IDAHO

John F. Shelley, owner of the Shelley Light & Power Company, Shelley, Idaho, has sold eighty-five per cent of his holdings in the company, and at a recent meeting new officers and a board of directors were elected, as follows: H. L. Malcolm, president; F. C. Mickelson, vice-president; F. M. Davis, secretary; W. S. Wright, treasurer; John Jorgensen, manager; T. J. Bennett, Nelson Miller and Edward Wadsworth are additional directors. The new owners intend to make several important improvements. Another unit will be added to the plant, and an electric supply shop will be opened.

THE CAPITOL FROM THE AIR



The Army Air Service is now cooperating with map-making companies in making detailed maps of the immediate vicinity of Washington. The above view of the capitol was taken by the 15th Aerial Photographic Section, Air Service, U. S. Army. It must not be reproduced without permission.

RATE INCREASES IN OREGON MUST BE AUTHORIZED BY COMMISSION

Public utilities in Oregon cannot advance their rates or charges without a public hearing before the Public Service Commission and an order from that body authorizing the increase, according to an opinion prepared by Attorney-General Brown. "It is apparent that if the rates prescribed by the commission may be abrogated by the utility filing a new schedule, the force and effect of the commission's order amounts to little," the opinion holds. It is Mr. Brown's opinion that, as far as rates which have been fixed are concerned, the only way to change the same is by a suit in court or by a complaint with the commission on the ground that they are unreasonable, or by original complaint filed with the commission.

COMMITTEE FORMED IN CALIFORNIA ON ELECTRICAL SAFETY MATTERS

The Joint Committee on Electrical Safety Matters, recently formed in California, with main committee headquarters in San Francisco, has outlined its plan of organization and elected W. M. Shepard as chairman and R. A. Balzari as secretary. This plan is to be submitted to each of the organizations comprising the committee, that is, the Pacific Coast Division N. E. L. A., California Electrical Contractors and Dealers' Association, A. I. E. E., Manufacturers' Safety Association, Pacific Coast Division Electrical Supply Jobbers, San Francisco Electrical Development League, and California Association of Electrical Inspectors. The Los Angeles Subcommittee will consist of a member from each of the foregoing except the Development League.

It is the committee's object to consider such safety or safety legislation matters as are of general interest to the entire electrical industry. Its motive is to represent the electrical industry on safety matters and to assist the Industrial Accident Commission in applying their safety orders.

SOUTHERN CALIFORNIA EDISON COMPANY APPLIES FOR CONSTRUCTION CERTIFICATE

The Southern California Edison Company on Oct. 4 applied to the Railroad Commission of the state of California for a certificate of convenience and necessity under which to undertake the construction of reservoirs, conduits, tunnels and power plants declared to be necessary if the company is to meet demands upon it for electric energy, these demands being in excess of present generating capacity. The plans propose a reservoir at Florence Lake with a capacity of 43,224 acre-feet, formed by the construction of a concrete arch and gravity dam 126 ft. high and 2,970 ft. long, costing about \$2,226,000. From this reservoir to Huntington Lake there is proposed a tunnel 68,000 ft. long, 15 ft. in diameter, with a carrying capacity of 1000 c.f.s., costing about \$11,800,000.

A reservoir at Shaver Lake of 138,570 acre-feet will be formed by a reinforced concrete multiple arch dam 2300 ft. long and 183 ft. high across Stevenson Creek, the cost to be about \$4,310,000.

Big Creek Power House No. 2-A, an extension of the present Big Creek Power House No. 2 and of similar construction to it, is provided in the plan. This will operate under a mean static head of 2,418 ft., the capacity of the station being 300,000 hp. and the cost estimated at \$9,950,000, including necessary equipment.

From Shaver Lake dam a tunnel 17½ ft. in diameter and of 1500 c.f.s. carrying capacity, 13,900 ft. long, is to be built toward Big Creek Power House 2-A. The lower end of the tunnel will join two penstocks weighing 30,000,000 lb., extending to the water wheels of the power house. Estimated cost of the tunnel is \$2,140,000 and of the penstocks, \$4,780,000.

Across Big Creek, below Power House 2-A, will be built a cyclopean arch concrete diversion dam 210 ft. long, 58 ft. high, at an estimated cost of \$104,000. From the forebay of this dam is to be a tunnel 20 ft. in diameter of 2,575 c.f.s. carrying capacity and 5,633 ft. in length through solid granite toward the new Big Creek Power House No. 8. The lower end of the tunnel will connect with four parallel penstocks to four water wheels in this power house. Each wheel is of the reaction type, connected through a vertical shaft to its alternator, the combined capacity being 120,000 hp. An outdoor bus and transformer station is to be constructed near No. 8 to transform the station output to three-wire, three-phase, 150,000 volts. Estimated costs are given as, tunnel, \$1,300,000; four penstocks, of 6,250,000 lb. weight, \$1,000,000; Big Creek No. 8 power house, including equipment, transformers, etc., for 90,000-kw. capacity, \$2,700,000; miscellaneous structures, \$100,000; one and six-tenths miles of 150,000-volt transmission line, \$16,000.

N. E. L. A. STARTS MONSTER PUBLICITY CAMPAIGN

In a letter to the members of the National Electric Light Association, George F. Oxley, director of publicity of that association, sets forth the plan of the good-will campaign which the N. E. L. A. has launched on a very large scale. Already a million copies of the literature have been ordered, but that number is far short of the amount that will eventually be ordered if the association's message is to reach every user of electric light and power in the country.

Mr. Oxley outlines the situation existing today in the industry, touching on the lack of power under unprecedented demand, the constantly increasing volume of finances which must be poured into the industry to permit its development, the difficulty in getting money and the high rates which must be paid for it, the necessity for taking the consumers absolutely into the confidence of the utilities and making them

realize the co-partnership existing between consumer and central station.

Quoting from the letter:

"It is with a full realization of these fundamental facts that the N. E. L. A. has inaugurated a good-will campaign, which it is hoped and expected will be the largest campaign of its kind ever undertaken by the industry. Through the medium of its 'Kilo Watt' campaign, more than one million homes will be reached every month with a message, first, regarding the uses of electricity and on terminology of the electrical industry, and later regarding the problems of finance and operation. Through the public press and other popular magazines articles directed towards the same end already are appearing and will continue to appear during the year's campaign. Manufacturers of electrical machinery, equipment and appliances will devote a large part of their advertising space to national advertising mediums and in the smaller magazines and local newspapers to cooperation in this campaign. The Investment Bankers' Association of America is cooperating in the campaign and has prepared a series of pamphlets which will go out to at least 500,000 electrical industry security holders each month."

Three pieces of literature being used in this campaign are the "Kilo Watt," which is a story of Mr. Kilo Watt, "Everyday Electrical Terms and Usage" and "Facts Every User of Electricity Should Know."

EMPLOYEES PURCHASE 40% OF PUGET SOUND POWER NOTE ISSUE

Establishing what is said to be a new record for bond sales in the Northwest, the Puget Sound Power & Light Company, Seattle, recently disposed of \$1,000,000 worth of five

Form M17-A 5051 1-7-20

PUGET SOUND TRACTION, LIGHT & POWER CO.
SEATTLE DIVISION

MEMORANDUM

To Mr. **U.R. THIRIFTY** Seattle, **September 18, 1920.**

From Mr. **I.C. INTEREST**

Subject **GROWING all over the district in our 5-year, 8% Gold Coupon Notes.**

Dear **Buddy**:

As our quota for the Seattle Division is only \$550,000 my thought is that—

FIRST: Every employee THAT CAN should get in before it is too late, as aside from being an unparalleled investment, it would be a wonderful testimonial to our personnel. 8½ employees in or better would top the record.

SECOND: It still would be more wonderful if each of the approx. 700 employees of the Seattle Division could have set opposite their names the record of at least one sale to a non-employee. Even at the lowest denomination this amounts to \$70,000. From this you can see the possibilities. Each surely has from one to ten friends who would greatly appreciate this investment opportunity being brought to their attention. Orders coming in so fast we may have to close sale before Saturday, Sept. 25.

Sincerely yours,
R.W. Clark.

The effective letter which helped make bond holders of over 1000 of the Puget Sound Company employees.

year, eight per cent, gold coupon notes in eleven working days, although twenty days' time was assigned to complete this task. The notes were in denominations of \$100, \$500 and \$1,000. An executive of the company, commenting on the results, said:

"An interesting example of the modern tendency toward cooperative ownership of large corporations is shown in the subscription list for the \$1,000,000 note issue of the Puget Sound Power & Light Company just closed. Through the efforts of the organization itself and without any underwriting by bond houses, the issue was distributed all over the territory served, from the Canadian boundary to Olympia, in small sizes and in many hundreds of subscriptions.

"Over 1,000 employees of the company (more than one-half of the total number of persons employed) became interested in the company's securities in this short space of time and the purchases by employees alone absorbed more than 40 per cent of the total issue. The participation by the public served and the employees in the ownership of the property is bound to result in a benefit to all concerned through keeping the income from the securities in the Puget Sound district and in broadening the interest and understanding of the company's operations and problems in the 147 communities served."



Nothing is more successful in telling the story of electricity than these attractive pamphlets which are being distributed by the Publicity Department of the N. E. L. A.



TALKING MACHINES were invented by Edison in 1878. If yours keeps the baby awake and must be sold,

THE SEARCHLIGHT SECTION IS AT YOUR SERVICE

GREAT WESTERN'S 1919 FINANCES SHOWN IN ANNUAL REPORT

Touching on the progress and scope of the activities of the Great Western Power Company of California for the fiscal year ending December 31, 1919, shown in the letter from the president to the stockholders, there appears a consolidated statement of income and profit and loss, with inter-company items eliminated, as follows:

Operating revenues.....	\$5,172,877.86
Operating expenses	2,065,893.25
Net earnings	3,106,984.61
Other income credits.....	240,116.18
Gross income	3,347,100.79
Income charges	652,921.94
Net income before charging interest on funded debt	2,694,178.85
Interest on funded debt.....	1,667,839.91
Net income for the year.....	\$1,026,338.94

RECLAMATION BILL TO BE PRESENTED AT NEXT CONGRESS

The reclamation bill calling for a \$500,000,000 appropriation to be presented to the next session of Congress will be framed by the Northwest Reclamation League, formed recently at Seattle. In presenting this bill, the league will work in conjunction with the Western States Reclamation Association, the parent body, and other Western reclamation bodies, it was announced by James Ford, secretary. The proposal is to lump the reclamation appropriation under one general bill and then to have the disbursements made equitably among the various Western reclamation projects.

GROWTH OF CENTRAL STATIONS IN THE WEST. IN 1920

During the present year, the central stations in the Western states are adding capacity and transmission lines to the extent of nearly \$35,000,000, according to results taken from a recent survey of the central-station industry of the United States, made by the Electrical World, and shown in the accompanying table. An addition of 61,458 kw. is to be added to steam plants this year at a value of \$5,861,855, while to hydroelectric plants the additions will amount to 186,500 kw., valued at \$28,709,591. Total additions are 247,958 kw., representing \$34,571,446. Because some companies do not contemplate plant additions but will make transmission additions, and some report both generating and transmission additions, it is not a true indication of the cost per kilowatt installed to divide the total value of all additions by the increased plant installation.

From the report, about 1,500,000 kw. will be added to generating capacity in all the states of the Union, and the value of these additions will approximate \$150,000,000. These figures are interesting in view of the unusually high cost of money, labor and materials.

CALIFORNIA CONTRACTORS ACTIVE FOR MORE OUTLETS

As a result of the electrical homes which have been conducted by the California Electrical Cooperative Campaign, the necessity for ample provision being made in new construction for convenience outlets has been brought home forcibly to the California State Association of Electrical Contractors and Dealers which is itself a part of the Cooperative Campaign.

To the end that some uniform action may be devised which will bring forth this result, a committee from the California State Association of Electrical Contractors and Dealers has been formed and has requested meetings with similar committees appointed from the A. S. M. E., the A. I. E. E., and the I. E. S. for joint consideration of this matter. It is interesting to note the desire of the California State Association of Electrical Contractors and Dealers to get away from individual effort and through cooperative means put this forward movement on a broad basis.

SESPE POWER CORP. PLANS FIVE WATER-POWER UNITS ON SESPE RIVER, CALIFORNIA

Sespe Power Corporation, which plans the construction of five hydroelectric power units on the Sespe River, Ventura county, California, on Sept. 28 was authorized by the Railroad Commission to issue \$2,000,000 of bonds and \$1,000,000 of its common stock to secure funds with which to carry out its development program. The company asked for a \$3,000,000 bond issue. None of the money raised by the stock and bond issue is to be expended, however, until there are sufficient funds on hand to construct the plants expeditiously. In the event that the company is unable to finance the project, the money is to be returned to the stockholders, says the Commission, less such an amount as may be allowed by the Commission for expenses. Among the restrictions governing the financing of the proposed new utility is one requiring that for every \$1,000 bond sold the company must sell concurrently at least \$1,000 of stock at par. Of the authorized stock issue \$100,000 is to go to the Sespe Light and Power Company for the properties the Sespe Power Corporation proposed to develop.

The Sespe company's estimate of construction costs totaled \$3,722,748. The Commission's engineers say this figure is entirely too low. Their estimate is \$5,500,000. The corporation's estimate of output, 197,962,017 kilowatt-hours, is not concurred in by the Commission's engineers, who hold that only an average annual output of 75,000,000 kilowatt-hours can be depended upon.

Authorization is given the company to enter into an agreement with the Southern California Edison Company to sell to the Southern company the output of the hydroelectric plants.

Additions to Mountain and Pacific State Central Station Capacity and Transmission Lines During 1920.

	STEAM PLANTS			HYDRO-ELECTRIC PLANTS				
	Capacity Jan. 1, 1920 K.W.	Additions 1920 K.W.	Value of Additions	Capacity Jan. 1, 1920 K.W.	Additions 1920 K.W.	Value of Additions	Total Additions K.W.	Total Value of Additions
City of Tacoma Light Department						\$ 30,000		\$ 30,000
Colorado Power Co.....	4,775	1,475	\$ 135,000	24,000			1,475	135,000
Eastern Oregon Light & Power Co.....	450	1,500	175,000	26,900			1,500	205,000
Great Western Power Co.....	26,000			2,550	44,000	8,500,000	44,000	8,500,000
Los Angeles Bureau of Power and Light				65,000	30,000	2,750,000	30,000	2,750,000
Los Angeles Gas & Electric Corporation	22,908	13,333	681,480	30,500				
Pacific Gas & Electric Co., Phoenix, Ariz.....	750		250,000				13,333	250,000
*Pacific Gas & Electric Co.....	117,000	12,500	950,000		1,000	2,096,200	13,500	3,046,200
Pacific Power & Light Co.....	6,240	3,750	1,300,000	15,775			3,750	1,300,000
San Joaquin Light & Power Corporation	16,750	11,900	930,375	32,000	40,000	2,698,391	51,900	3,628,766
Seattle Municipal Light & Power Co.....	22,500	15,500	1,250,000	14,875	15,000	1,075,000	30,500	2,325,000
Southern California Edison Co.....	107,482			119,190	46,500	10,000,000	46,500	10,000,000
Utah Power & Light Co.....	16,000			113,475	10,000	1,530,000	10,000	1,530,000
Wenatchee Valley Gas & Electric Co.....		1,500	190,000	2,750			1,500	190,000
Western States Gas & Electric Co.....	2,250			6,075				
TOTAL WESTERN STATES.....	343,105	61,458	\$5,861,855	647,965	186,500	\$28,709,591	247,958	\$34,571,446

*Includes Pacific Gas & Electric Co., Northern California Power Co., Sierra & San Francisco Power Co.

RATE INCREASE ASKED BY LOS ANGELES GAS & ELECTRIC

Los Angeles Gas & Electric Company has applied to the California Railroad Commission for authority to increase its electric rates, saying that the present rates are those in effect before the war.

SAN JOAQUIN STARTS WORK ON A NEW 60-MILE LINE

Work has been started on a high-tension power line 60 miles long connecting the San Joaquin Light & Power Corporation's new Kerckhoff power house with Merced, where a new transformer station is now under construction. The power will be stepped down for distribution in the Merced district to serve a large number of farm pumping plants on the waiting list. The line will also connect with the Pacific Light & Power Company's main line at Newman for interchange of power between the Sacramento and San Joaquin valleys. The new line, having a capacity of 30,000 kilowatts at 110,000 volts, will pass through 25 miles of mountains in a 50-mile course due west from the Kerckhoff power house, to a point south of Merced, when it will change course north-erly for a distance of 15 miles.

BETTER OUTLOOK IN HOME BUILDING INDUSTRY

Two matters of interest have recently come to the fore which would appear to be important factors in new residence construction. In the first place the American Wholesale Lumber Dealers' Association, according to an announcement by L. R. Putnam, managing director, has made an average cut in lumber prices of 28 per cent from the February price list. At the same time it is not unreasonable to expect this cut in lumber prices to affect other building-material lines.

In the second place, representative M. C. Kelly of Pennsylvania is reported to be framing a bill which he will introduce at the December session of Congress which will provide for the loaning of money by the Postal Savings Banks to persons wishing to build homes. The bill is aimed to relieve the housing situation and its sponsor declares that there are 55,000,000 persons in the United States living in rented houses, many of whom would build if they were provided with the necessary cash at a reasonable rate of interest. He urges removal of the \$2500 deposit limit, an increase in the rate of interest, and seeks provisions for loaning money to persons within the postal districts.

FLYING DE LUXE



The passenger compartment of a Handley-Page passenger airplane which has been making regular flights between London and Paris since May 1. In six months of flying, and with a mileage of 303,000 miles there were only two fatalities on this line, both to pilots.

RATE INCREASES GRANTED TO PACIFIC POWER & LIGHT

The Public Service Commission of Washington on September 29 handed down a decision in the case of the Pacific Power & Light Company concerning applications for rate increases made in March on all cities and towns served by the company in Washington, involving gross annual increases of \$240,000.

All the company's requests were granted with the exception of Yakima, Walla Walla, Pomeroy and Toppenish. The proposed increase at the first two were reduced by 1 cent net on each step, and on the other two by ½ cent net on each step. All rates go into effect as of meter readings taken on Sept. 15 and later. No change was asked for in cooking or irrigation power. The increases cover domestic and commercial metered lighting, flat commercial lighting and commercial and flour milling power.

WASHINGTON WATER POWER TO EXTEND LINE

An extension of the power line of the Washington Water Power Company, Spokane, Wash., from Colfax to Albion, a distance of ten miles, at an estimated cost of \$25,000, was announced by W. E. Coman, general manager of the company, early this month. Work on the line will begin immediately. There will be at least 30 extensions to farmers along the way, virtually every farmer between Colfax and Albion having signed up to take advantage of the electric power. Already the people of Albion and the farmers are beginning to buy washing machines, vacuum cleaners and other electric appliances, it is reported.

TRADE NOTES

Offices Established in Oregon —

The Coast Equipment Company, of which L. A. Somers is the Pacific Coast representative, has arranged for Messrs. Conway & McCalley to handle its business in Oregon. Offices will be maintained in the Lewis Building, Portland.

The Coast Equipment Company is now operating offices in Los Angeles, San Francisco, Portland and Seattle.

Contract Awarded —

The McMyler Interstate Company of Cleveland, Ohio, with offices in the Merchants Exchange Building, San Francisco, and the Hoge Building, Seattle, were recently awarded a contract by the Port of Astoria, Oregon, for four electrically operated cargo cranes.

Distribution Manager in the West —

P. A. Boeck, manager of distribution of the Celite Products Company, New York City, is now located at the company's Los Angeles office where he will supervise the production work. Thos. G. Lee, Jr., will act as general sales manager with headquarters in New York.

Consulting Engineers Consolidate —

J. C. Stevenson and R. L. Koon announce their consolidation, Oct. 1, under the firm name, Stevens and Moon, Consulting Engineers, Portland, Oregon. They plan to give particular attention to matters pertaining to municipal improvements, water supply, sewerage, irrigation, hydroelectric power, appraisals and valuation.



CASH REGISTERS were invented by Pat-
terson in 1885. Don't use yours as a
paper weight if you've anything to sell.

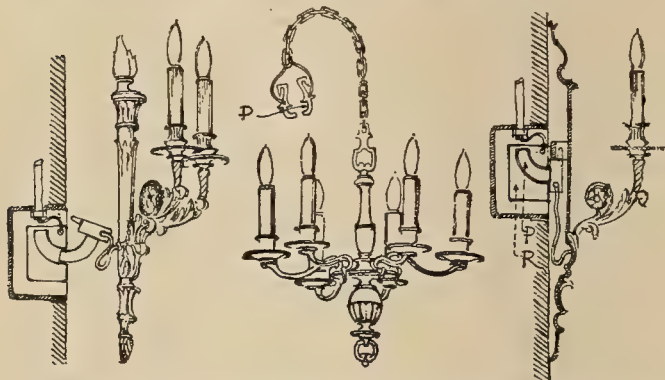
THE SEARCHLIGHT SECTION
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LATEST IN EVERYTHING ELECTRICAL

(A very probable solution to the problem of fixtures out of harmony with the furnishings of a room is presented on these pages along with descriptions of a new type bushing for the outdoor transformer; the latest helps for exposed wiring, and a new appliance which will be of especial value both in the industrial and domestic world. Reviews of the 1920 edition of the McGraw Central Station Directory and of a remarkable booklet on California hydroelectric securities are among the Books and Bulletins.—The Editor.)

MAKING FURNITURE OF FIXTURES

It is not unlikely that the electric lighting industry is on the crest of a wave of expansion that will make the present proportions of the industry seem insignificant within a few years. If this prediction is fulfilled, the credit will again be due to the constant stream of new ideas.



The placing of a wall bracket fitted with a White supporting plug is shown on the left. In the center is a chandelier with its hook-like contacts, while to the right may be seen a bracket in place on a White supporting outlet.

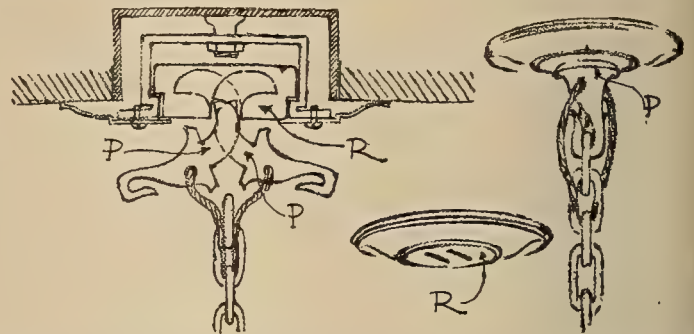
Up to a few months ago, soldering and tapering was the only method used to install chandeliers and wall brackets. From an illumination point of view this method, despite the fact that it has been the standard accepted practice, is woefully inadequate. A fundamental law of correct illumination is to supply light where it is needed. The method that has been in practice reversed this procedure—the need must be brought to the light. It was like bringing the mountain to Mohammed. The chandelier was made fast to the ceiling; or the wall bracket fastened to the wall, and the furniture in the room arbitrarily arranged to fit the needs of illumination.

Shortly after the beginning of this year, a rumor was current among electrical men that a new invention had been evolved which would revolutionize the present system of electrical "fixture" installation. Confirmation of this report was soon found in the formation in New York City of an organization to promote such a development. The inventor is E. Cantelo White, who is manager of the general lighting department of the Western Electric Company. Mr. White has to his credit the invention of the Duplex system of lighting, as well as the standard plug connection.

The new connection for chandeliers consists of a ceiling receptacle into which two curved prongs fit snugly. The ceiling receptacle slots are curved like two arcs backed one against the other, the plug consisting of a pair of independent curved contacts held securely in place by a link of the supporting chain. The curved contacts lock into place and provide the support of the lighting fixture.

Similar though it is in principle to the baseboard connection, it can be readily appreciated that here the similarity ends, for in the baseboard connection the receptacle slots would be vertical and provide no support for the chandelier, while in Mr. White's invention they are curved, to give the necessary support. Outwardly the receptacle is a neat, scarcely visible little plate, which is flush with the ceiling.

To hang the chandelier it is merely necessary to slide the plug prongs into the receptacle slots and lock them in position by clipping the supporting link over the protruding hooks of the contacts. The wall bracket connection is not very different. The curved plug prongs, or contacts, instead of curving in opposite directions, parallel one another; while the

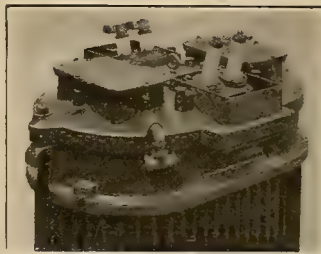


To the left is shown the method of inserting the curved contacts for ceiling fixtures. The ceiling outlet, or curved receptacle with curved contact slots, is shown in the center, while the complete connection appears to the right.

receptacle is provided with two similarly curved arc-shaped slots. A down-and-up adjustment of the bracket permits the prongs to enter and snap into place, the base of the plug resting firmly against the face of the receptacle plate. Fixtures may be removed as easily as they are installed—by an upward movement.

TRANSFORMER HOUSES MAY BE ELIMINATED

A new type of bushing for outdoor type transformers of moderate voltage has been developed by the General Electric Company. This bushing has received the approval of the inspection department of the Associated Factory of Mutual Fire Insurance Companies. The scheme provides that all circuits, generally above 600 volts, be brought to the housing in enclosed cables. This cable is above ground, in a metal duct which is securely fastened to the transforming cover, all exposed parts being at ground potential, and water-proof.



The new type of bushing

The water-proof feature is essential, from the Underwriter's standpoint, in making it safe for firemen to play streams on burning buildings near the transformers.

The lower portion of the bushings is similar to the standard General Electric high voltage bushing, while the upper portion is shown by the illustration. Ample clearance is provided in the housing. The transformers receive standard high potential test with housing position and without any taping or other insulation on the bushings. The use of these transformers is only limited, as regards voltage, by the voltage limits of the underground cable.

NEW CONDUIT BODIES FOR EXPOSED WIRING

Four representative outlet-box manufacturers have recently brought out a line of pressed steel conduit boxes with knockouts—a line so highly standardized that virtually the whole range of exposed conduit wiring requirements for $\frac{1}{2}$ -in. and $\frac{3}{4}$ -in. conduits is compassed with but three basic bodies and two connectors, which, when combined in any form desired, result in a conduit body.

To meet the requirements of exposed wiring a conduit body must be rigidly connected to the conduit without support. The connector affords just such a rigid arrangement, according to the statement of the manufacturers. The two connectors employing the Chase nipple features, one designed for $\frac{1}{2}$ -in. conduit and the other for $\frac{3}{4}$ -in. conduit, both fit the one size of knockout used in all the three bodies.

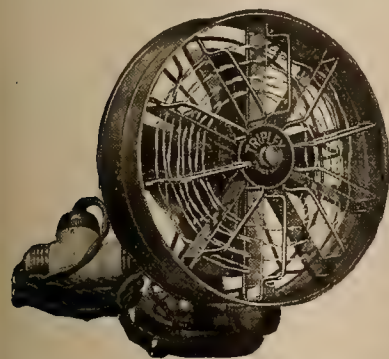
These conduit bodies are adaptable to virtually any standard make of wiring device. With three bodies, two connectors and fifty-five covers, there are few standard exposed wiring device jobs that cannot be handled.

It is expected that these conduit bodies will effect economy through low stock investment for a complete line, with a corresponding reduction in shelf space; through saving in time of wiremen who can almost instantly adapt a conduit body to virtually any standard condition, and through their ready reception of any standard make of wiring device, thus eliminating the necessity of duplicating stock investments.

The new line is being exploited independently by the Sprague Electric Works, which has adopted the trade name of "Spraguelets"; Thomas & Betts, who are calling their line "T & B Conduit Bodies"; the Pratt-Chuck Company, which names its product "Pratt Conduit Bodies," and the Steel City Electric Company, which has adopted the trade name "Wirelets."

A COMBINATION FAN AND HEATER

Circulating heat is often of inestimable value both in the industrial and domestic world. For this reason a combined fan and heater has recently been developed and placed



The Triplex combination fan and heater which is valuable for either drying hair in the home or spaghetti in the factory.

on the market by the Thermo-Fan Electric Co., Inc., 2 Columbia Circle, New York City. A special nichrome heater coil is attached to the guard of a standard electric fan and the operation of the Triplex blows air through the coil, heating it and circulating it through the room. The Triplex attaches to any socket, plugged in with a current tap, giving independent connection to fan and heater. The fan and heater operating together consume 660 watts in the domestic size. In larger sizes it is being made for drying photographic work, printing, oils, tobacco, spaghetti, and in many other processes where a controlled circulating heat is needed.

MERCHANDISING HELPS FOR THE ROYAL DEALER

The various methods of advertising the Royal vacuum cleaner, manufactured by the P. A. Greier Company of Cleveland, Ohio, have been presented to the electrical dealer in a beautiful 12 x 18-in. booklet. Samples of national magazine and newspaper advertising are shown, notice being given that the cuts shown will be furnished any dealer on request. Samples of various types of window posters are also given.

Books and Bulletins

McGraw Central Station Directory and Data Book 1920 Edition

Compiled by the McGraw-Hill Company, Inc., and published by the McGraw-Hill Book Company, Inc., 239 West 39th St., New York: 870 pp., 4 x 8½ in. On sale at the San Francisco office of the McGraw-Hill Publishing Company, Rialto Building, San Francisco.

All the resources of the McGraw-Hill organization, its field force, its editors and its correspondents, have contributed to make the 1920 edition of the McGraw Central Station Directory and Data Book a complete survey of the electric lighting and power field.

Under each state section, all cities and towns possessing a power plant or substation of any size are listed alphabetically. Under each city or town division the population is given first, then every power organization, municipal or private, is listed. Under the name of each of these organizations the main office address, history, system, valuation and officers are given. It can be seen that this directory of 6,133 electric lighting, power and transmission systems serves not only as an inventory of the power plant and substation equipment of the lighting and power field, but also as a Who's Who of the electrical industry, as a mailing and calling list for salesmen and as a reference book for cost of plant, capacity, load, city lighting contract, kind and price of fuel, population reached, and meters in service.

A special feature of the 1920 edition, now ready for distribution, is an inserted table reprinted from the May 15th issue of the Electrical World. This gives the status of domestic and commercial electric service by states and sections. Men of the West will be especially interested to note that this section of the country ranks highest in the column which gives the percentage of dwellings electrically wired, taking into consideration the total number of dwellings in the territory, and also in the column which shows the proportion of the population living in electrically wired homes.

The electrical industry is changing and growing in leaps and bounds all over the country. New plants are continually being constructed and new inter-connections made. Gas and oil engine development and changes in lighting contracts, fuel prices, personnel and in the population reached by the central station are so numerous that the average man finds great difficulty in keeping abreast with the industry. For this reason the McGraw-Hill Company is rendering a recognized service in bringing every edition of this directory down to the minute.

Determining the Resistance of Metals and Alloys to Wear

The Holz & Company, Inc., Metallurgical Engineers, New York City, are sending upon request their recent book which explains the newly developed methods of determining the resistance of metals and alloys to wear.

The company states that although variations in chemical composition and heat treatment have a decided influence on the wearing properties of metals, it has been definitely established that there is no relation between these properties and the so-called hardness of the metal.



THE COMPASS was invented in 2634 B.C. by Emperor Hon-ang-ti. If you want to get anywhere, start in the right general direction:

THE SEARCHLIGHT SECTION
IS AT YOUR SERVICE

NEW ELECTRICAL DEVELOPMENTS

(News on dock and pier construction comes from the Northwest along with reports of plans for improved street lighting systems. The Pacific Central district reports the removal of the ban on the use of electric power for lighting in San Francisco, negotiations between power companies for the purchase of power, and plans for the Hetch Hetchy power plant. Activities of municipal light and power departments are reported from the Southwest and interesting plans for the moving of a city in the construction of a dam are among notes from the Intermountain district.—The Editor.)

THE PACIFIC NORTHWEST

SPOKANE, WASH.—The Washington Water Power Company has announced that steam heating rates in Spokane will be increased from 5 to 15 per cent, due to the increased freight rates on coal.

PORTLAND, ORE.—The Eastern & Western Lumber Company, Portland, have had plans prepared for a power plant to cost \$25,000. The structure will be of steel construction with stucco exterior, and will be built by day labor.

STAYTON, ORE.—The Stayton Power Company is increasing the capacity of its plant by the installation of a 210-hp. water wheel. This will give the company additional capacity to take care of growing demands for power.

PORTLAND, ORE.—General Harry Taylor, assistant to chief of the United States Engineers, and six engineers of the war department will visit Portland during October on an inspection tour of the rivers and harbors of the Northwest.

SALEM, ORE.—The Creswill Electric Light & Water Company has filed with the public service commission an application for an increase in rates. It is charged in the company's application that the present revenues of the company are insufficient to pay operating expenses.

BURNS, ORE.—At a meeting of the city council held September 3, estimates for the installation of the proposed municipal light plant, water and sewer system were submitted by I. C. Kelsay, engineer. The estimated cost of the project was given at approximately \$300,000.

ST. HELENS, ORE.—Plans for the organization of the Marshland drainage district, comprising some 1000 acres near St. Helens, in Columbia county, have been submitted to the state engineer's office for approval. It is estimated that the development will cost approximately \$50,000.

VANCOUVER, B. C.—The Northern Construction Company of Vancouver has been awarded the contract for building the Ballantyne pier and quay. The firm's bid for this work was approximately \$4,500,000, and covers the erection of the whole of the big concrete pier and concrete freight sheds and their equipment.

PORTLAND, ORE.—F. H. Barstow, local manager of the Federal Telegraph Company, reports that his company has purchased a large site at Hillsboro, to be used as the location for a wireless station. The plant will consist of a 620-ft. tower to hold two sets of antennae, and other buildings, to cost about \$200,000.

CHEHALIS, WASH.—A proposed lighting system is being worked out for the city of Chehalis, the plan being to establish a local improvement district in which the property owners will pay for installing the uniform standard lighting system to take the place of the present inadequate lighting and remove the poles from the main business streets.

PORTLAND, ORE.—The Public Dock Commission has awarded to the Westinghouse Electric & Manufacturing Company the contract for furnishing ten 100-horsepower motors and compensators for the new 15,000-ton drydock to be erected by the Port. The company's bid was \$29,040. The only other bid was submitted by Allis-Chalmers Company.

GARIBALDI, ORE.—The installation of the 2000-kw. Curtis turbo-generator at the sawmill of the Whitney Lumber Company at Garibaldi has been completed, and the mill, which is to be electrically driven, will soon be in operation. The generator is being used at present to operate an electrically driven dredge, which is deepening the harbor to accommodate lumber carriers.

ROSEBURG, ORE.—Douglas County Light & Water Company has secured an order suspending the recent rate increase granted by the Public Service Commission, for a period of six months, during which time a new showing will be made in an effort to secure a further advance in lighting and power rates. The company claims it has been operating at a loss due to a large amount of steam operation caused by light rainfall during the last year.

HOQUIAM, WASH.—The only bid submitted to the city council for installing and furnishing electric energy for the boulevard lighting system proposed for the business district was that of the Grays Harbor Railway & Light Company. The bid was much higher than had been estimated by city officials. The company bid \$108 per post, whereas the estimate was \$85. Energy covering the full night would be charged at the rate of \$48 per year for each post, and \$35 for a half-night's energy. About 45 posts will be installed.

SALEM, ORE.—Application covering the storage of 1,600,000 acre-feet of water in the upper Klamath lake for the irrigation of lands and development of power in California has been filed with Percy A. Cupper, state engineer, by Roy E. Swigart, president of the Shasta Valley Irrigation Project of Montague, Cal. Some time ago another application was filed by Swigart on behalf of this project, covering the appropriation of 1,500 second-feet of the waters of Klamath river for irrigation and power development. The latest application filed here contemplates the irrigation of approximately 150,000 acres of land.

BELLINGHAM, WASH.—In the condemnation suit of the city of Seattle against the Bingham Investment Company of Sedro Woolley, a jury recently returned a verdict placing the value of the tract of land sought for the Skagit power site at \$27,500. The city corporations counsel's office is expected to appeal to the State Supreme Court, objecting to rulings of the judge submitting certain evidence, and also to some of the court's instructions. Charles Bingham, a Sedro Woolley banker, paid \$3,000 for the 130 acres of land one year ago. The present value of the land has been placed at all the way from \$1,500 to \$60,000. Two real estate men valued it at \$18,000 to \$20,000 for townsite purposes, while engineers said it was worth \$60,000 as a site for a hydroelectric plant.

TACOMA, WASH.—The estimated budget for the light and water department for next year, prepared by Commissioner Ira S. Davison, calls for an increase of \$10,000 for maintenance and provision for new business, over last year. The department is self-sustaining and the budget is not raised by taxation. Estimated operating revenues for the next year in the light department alone total more than a million dollars. For an increase in operating expenses of the

light department of \$30,000, the new estimate contains a single item of \$25,000 for the purchase of additional power from the Tacoma Railway & Power Company which will be required to run the business. During the next year a large sum will be required for repair and replacing of pipe lines and wooden water mains. Total operating expenses in the light department for the coming year will be \$321,600.

THE PACIFIC CENTRAL DISTRICT

OAKLAND, CAL.—Articles of incorporation have been filed by the Berkeley Electrical Company with County Clerk George E. Gross of Oakland. The firm, which will have headquarters in Berkeley, is capitalized at \$25,000.

SANTA CRUZ, CAL.—A deed has been filed by which the Mountain Light & Power Company transfers to the Santa Cruz County Utilities, for \$550,000, their holdings, the light and power companies of Boulder Creek, Ben Lomond and Brookdale, with their lands, equipment and water rights.

LODI, CAL.—City Engineer C. F. Brazelotti and Street Superintendent Henning have been instructed by the board of trustees to prepare plans and specifications for necessary improvement to streets, sewers, light and water systems as a preliminary to calling a bond election to raise funds. It is thought the amount required will reach \$100,000.

EL CENTRO, CAL.—It is announced that the weir installed at Hanlon's Heading cost \$30,000 to install, as reported by Supt. Cronholm. He also reports that the peak of water delivery orders has been reduced from 5600 to 5200 ft., which is the supply for the entire valley. There has been no water shortage at any point this summer, nor is any expected.

SAN FRANCISCO, CAL.—Recent heavy rains, bringing up the streams and releasing the power that has formerly been used for irrigation purposes, has caused H. G. Butler, San Francisco power administrator, to lift the ban prohibiting the use of electric power for signs or special display. The new order does not apply to all restrictions on power and certain plants within the city limits are still being restricted.

SAN FRANCISCO, CAL.—The Middle Yuba Hydro-Electric Power Company on Oct. 14 was authorized by the California Railroad Commission to increase its rate for electricity 15 per cent to cover the additional cost of power resulting from a recent increase granted the Pacific Gas & Electric Company which furnishes the Yuba company with electric energy. A public hearing on the company's application for financial relief was held at Grass Valley.

SAN FRANCISCO, CAL.—Gross earnings of the Pacific Gas & Electric Company for the eight months ending August 31 were \$2,705,763, according to a report issued by A. F. Hockenbeamer, second vice-president. This is an increase of \$5,455,350 in gross over the same period of last year and a gain of \$43,745 net income. In the same period there has been an increase of 23,920 consumers which, says the report, is the most satisfactory index of the company's continued and substantial growth, as the earnings for 1920 were influenced to some extent by the new rate schedule.

SAN FRANCISCO, CAL.—Plans for the city's big electric power plant in connection with the Hetch Hetchy project have been started by City Engineer O'Shaughnessy. This is the last large piece of work connected with the mountain division of the city's water project. It is estimated that the plant, with the machinery, will cost about \$6,000,000. It is to be built at the foot of what is known as Priest's Hill. The water will have a sheer drop at this point of 1,200 feet, and 400,000,000 gallons a day will pass through the weirs to the turbines.

SAN FRANCISCO, CAL.—An attractive and highly-secured, short-term, tax-exempt investment is offered the public by Freeman, Smith & Camp Company. The issue is \$100,000 7 per cent warrants of Sacramento and San Joaquin drainage district. Beginning February 1, 1921, the district will sell bonds after completion of the work to the amount of \$5,500,000 to retire those warrants, the total amount of which is \$300,000, purchased by a syndicate composed of the state board of control, San Francisco and Chicago banks.

CHICO, CAL.—W. A. Beard of the Sacramento Development Board appeared before the Board of Supervisors here and told of the new plan for building a dam in Iron Canyon, together with a system of irrigation canals, to irrigate land on the east as well as the west side of the Sacramento. A realization of the plan would bring water to the district northwest of Chico, a project which has been under consideration by the Chico Chamber of Commerce for the past six months. The new damsite will be located three miles from the site first proposed, and will store 750,000 acre-feet of water in the cup which is formed by the mountains.

SAN FRANCISCO, CAL.—Completion by the San Joaquin Light & Power Corporation of the Kerckhoff power plant in Fresno county and steam plants at Bakersfield and Midway having made available electrical energy beyond the needs of this company, the Pacific Gas & Electric Company applied to the Railroad Commission to authorize an agreement for the Pacific company to buy the excess energy from the San Joaquin. The Commission was asked to approve a plan by which the Pacific company will advance to the San Joaquin corporation sufficient funds to construct a transmission line from the Kerckhoff plant to the San Joaquin substation at Merced. Delivery to the Pacific company would be made at Newman.

JACKSON, CAL.—The Amador Electric Light and Power Company has been authorized by the Railroad Commission to increase its rates for electric energy. Testimony given at the public hearing of the company's application held at Jackson showed that depression in the mining business has reduced the company's business to such an extent that its revenues are not compensatory. Increased cost of purchased power and materials and labor have also helped to reduce the company's income. No protests against the proposed increase were made at the hearing in Jackson. The Commission's order establishes an entirely new schedule of rates. The increase on the average will amount to about 20 per cent on light and 10 per cent on power.

THE PACIFIC SOUTHWEST

LONG BEACH, CAL.—The Pacific Electric Railway has proposed the construction of an overhead crossing on North Atlantic Avenue.

PASADENA, CAL.—The Pacific Electric Railway will install a double curve at Colorado and Los Robles Ave, the improvement to cost \$22,000.

FLAGSTAFF, ARIZ.—The Arizona Lumber & Timber Company will build a dam near its mill, to dam in the waters which in the rainy season flood the city.

POMONA, CAL.—H. E. Boller of Chino has been awarded a contract for a new well in Ganesha Park. It is the intention to put down a well 55 feet below the level of the creek bed.

LOS ANGELES, CAL.—O. A. Smith, general passenger agent of the Pacific Electric, states that the company proposes to proceed with the repairing of the line on Echo Avenue at an early date.

LA VERNE, CAL.—At a mass meeting held in La Verne district, a committee was appointed to wait upon the Los Angeles county supervisors to guarantee the difference between the market and par value of bonds necessary to defray the cost of building Live Oak Dam in the mountains north of La Verne.

RIVERSIDE, CAL.—The directors of the Moreno Mutual Irrigation Company show that the company has acquired 800 acres of water-bearing lands in the San Timeteo canyon. Wells will be sunk on the tract and water carried 12 miles to Moreno Valley. Two thousand acres of dry farming land will thus be irrigated.

LOS ANGELES, CAL.—Chief Engineer Reagan has presented to the Board of Supervisors plans for the purchase of two large control gates to be placed in the tunnel at Devil's Gate Dam near Pasadena. When these gates are placed the dam will be completed. Bids are to be asked for the gates at an estimated cost of \$40,000.

LOS ANGELES, CAL.—The Southern California Edison Company has been authorized by the Railroad Commission of California to sell to the Ontario Power Company a 15,000-volt electrical distribution line located on Base Line Road, San Bernardino county, at a price of \$12,500. The transfer of the line will make it unnecessary for the Ontario company to build a line of its own.

CASA GRANDE, ARIZ.—Strenuous work is being performed by the Casa Grande Farmers' power committee in their efforts to secure electric power for this valley. They have secured a conditional proposition from the Salt River Valley that they are giving the most favorable attention. Project lines, financing, etc., are being worked out, and the plan of bringing current into this valley, if found practicable, will be given publicity in all its details.

MONROVIA, CAL.—Supervisor Prescott F. Gogswell of Los Angeles states that investigation shows that two or three small reservoirs, which would require the building of comparatively small concrete dams and which would be used for storage purposes, would be much more effective as flood control and conservation measures than check dams. He states that construction of the dams can be commenced as soon as some kind of a road can be built for delivery of materials.

PASADENA, CAL.—The city of Pasadena is investigating the possibility of getting additional current for the municipal light department from hydroelectric development in the San Bernardino mountains. The city commission has authorized an appropriation for expenses to C. W. Koerner, general manager of the municipal light plant, and Chief Engineer Samuel B. Morris of the city water department, for an investigating trip to a hydroelectric plant there. It was stated that the investigation is of power possibilities and not a water supply.

LOS ANGELES, CAL.—In order to meet the growing power needs of the city, Chief Electrical Engineer E. F. Scattergood of the municipal power bureau urged the Public Service Commission to proceed with the construction of the San Fernando and Franklin Canyon municipal power plants. The commission took under advisement the city council's resolution calling upon the commission to go on record to the effect that it will take care of interest and sinking fund charges on all power bond indebtedness out of the department's revenues.

THE INTER-MOUNTAIN DISTRICT

POCATELLO, IDAHO.—The entire city of American Falls, a city of several thousand population, located in southeastern Idaho, is to be moved several miles from its present location, to make room for the construction of a huge irrigation dam on the site of the present town.

ROUNDUP, MONT.—The city council has awarded to the Paulson Construction Company of Butte the contract for furnishing materials and equipping and installing an ornamental street lighting system in special improvement district No. 36. The contract runs about \$17,000.

LOGAN, UTAH.—It is reported that the city officials of Logan are considering the matter of calling an election for the voting of several hundred thousand dollars in bonds, the proceeds of which would be used to enlarge the present municipal electric power plant, or possibly to build a new plant.

WOLF POINT, MONT.—A charter has been granted by the state to the Listerud Power Co. of this city with an authorized capitalization of \$100,000. The new organization will take over the business and the plant of the Wolf Point Light and Power Company and continue to conduct the business.

NEPHI, UTAH.—The public utilities commission of Utah has made a decision permitting the city of Nephi, which operates a municipal plant, to increase its rates on electric light and power. The lighting rate is increased from 7 cents to 10 cents per kilowatt-hour, with a minimum of \$1.00 per month, and the heating and cooking rate from 2 to 3 cents per kilowatt-hour.

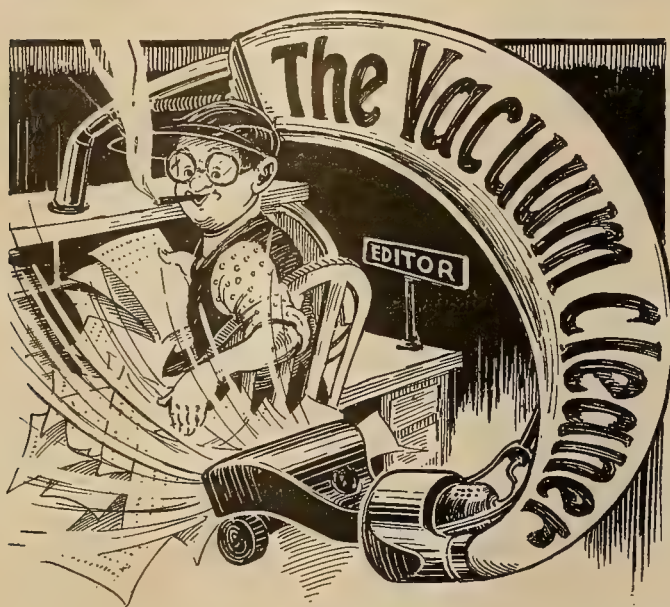
MILES CITY, MONT.—The cooperation of the city officials of Miles City, Terry and Glendive will result in the building of a hydroelectric plant at Buffalo rapids capable of generating 15,000 hp., which will eventually be the means of reclaiming 50,000 to 75,000 acres of land in eastern Montana. The project is assured of the necessary capital if the towns to be affected will sign contracts for electric power.

DENVER, COLO.—The Sethman Electric & Manufacturing Company expects to open the first of three buildings of its new plant Jan. 1. One year ago this company was incorporated for \$2,000,000, which will later be raised to \$10,000,000, according to George H. Sethman, president. The building about completed cost \$175,000, with equipment. Following this will be a machine shop covering an entire block.

OGDEN, UTAH.—The contract for the construction of the United States government arsenal building at Sunset, near Ogden, has been awarded. Materials are now being shipped in, and although the work will be rushed, the contract calls for completion of the work June 1, 1921. The plant will consist of about sixty buildings and it is estimated that 1000 horsepower of electrical energy will be required in its operations.

OGDEN, UTAH.—A cooking school, featuring the uses of electricity in the home, was held in Ogden during the week beginning September 27, conducted along similar lines to that held in Salt Lake City during the first part of August. The various merchants and manufacturers of Ogden displayed their products, and a cooking and baking program was carried out, demonstrating the various methods of preparing food products. An expert was on hand to demonstrate the uses of electricity to the housewives.

PROVO, UTAH.—The Utah Power & Light Company has filed an application with the district court of this district for 200 second feet of water, which it claims was filed on but never proved up, in Provo Canyon. The company states that it has spent \$2,000,000 in a power plant and flume in the canyon, and that the canal companies will interfere with its use of a total of 400 second-feet of water during the irrigation season, and asks the court to settle this question in the decree.



The true military spirit was displayed by a company of new recruits resting near the bank of a canal. The command of the officer to "Fall in" was followed by a loud splash.

* * *

Salesmanship is applicable to friends and neighbors alike. We didn't invent this story. It's true. A man hurried into Smith's store one morning, and having to wait around for a few moments began to look at an electric sweeper until the proprietor came up to him.

"What are those things worth?" he asked.

"One thousand dollars," replied Smith.

"What?"

"One thousand dollars."

"Sell for one thousand dollars?"

"Oh, heavens, no, you asked me what they were worth. They sell for sixty-five, but I can't sell you that one."

"Why?" challenged the customer.

"Why, because I sold it half an hour ago—but," he whispered, "in my basement, I've—another one."

The man's face registered satisfaction. "I beat rugs all day Saturday. Send it up to my house."

"I'll certainly do that," sang Smith. "If anything goes wrong, let us know, we'll fix it up for you," he continued, taking the money. "I'm glad that you came in to buy a sweeper."

"But I didn't," replied the customer, "I merely dropped in to borrow your wire cutters."

* * *

THINGS THAT NEVER WERE

A woman who could find her car fare within five minutes after boarding a street car.

An edition of the newspaper without a "Great Probe" in it. A group of passengers who knew exactly where to stand when waiting for a car to stop.

An editorial writer who neither "viewed with alarm" nor "pointed with pride."

A new serial that wasn't the author's "greatest."

A political candidate who didn't carry the washing home for his mother when he was a boy.

An electrical man who never played golf.

A movie comedy in which nobody fell into a rain barrel or a bucket of whitewash.

A plain or unpopular debutante in the society columns of the newspaper.

A newspaper boy with a musical voice and a strict regard for truth.

A car conductor who stopped saying "Step forward, please," when the car was full.

A big rainstorm that wasn't the heaviest the district had known at that season for over thirty years.

* * *

A sign of the times is a notice we saw recently outside a down town hotel:

"Large Dry Basement For Rent."

In 'the-good-old-days' they used to be called cellars.

* * *

PRACTICAL PROBLEMS IN ELECTRICITY

Before the great felicity
Of learning Electricity
Had made of me the whizz I am today,
I used to wonder how, when you
Put on extra lamp or two,
The generator knew it miles away.

And when I heard that if I stood
On insulators, then I could
Quite safely with live wires play around
I wondered how it could be true,
Or how the current ever knew
The other end of me was on the ground.

* * *

A new invention, originating in Holland, is "a telephone small enough for both transmitter and receiver to be carried in the vest pocket."

Very ingenious, but who wants a telephone mixed up with his watch?

* * *

Architecture is very important to the electrical industry, for which reason we quote the following treatise on the subject:

"A great architect is one who has been dead such a long time that he can be copied with impunity.

"A writer must be able to say many offensive things before he can become an authority on architecture.

"A school of architecture is a collection of men with the same unintelligible idea.

"Queen Anne knew nothing at all about the architecture of her period, in which respect she was no worse off than are the people who chatter about it today.

"Success in architecture can be achieved only through the medium of an appropriate vocabulary.

"A flourishing period of architecture in the past was fostered by the church. A flourishing period of architecture nowadays is fostered by the wives of millionaires.

"If bad architecture lasts long enough it becomes good.

"The most devoted lovers of the antique in architecture are the ghosts."

* * *

Only the initiated can understand some advertisements. Among recent items which have mystified us is the following, listed under Fixtures For Sale:

"Two-vault omnibus made in Jamestown."

Now we have seen omnibuses that were fixtures, but we never heard of the owners advertising them. And what is a "two-vault" omnibus, anyway? Does it refer to the method by which passengers board it?

* * *

A report states that "The tin plate market is very quiet." How do they do it?

* * *

Speaking of import duties on luxuries reminds us of Norway's recently published list of import prohibitions. The prohibited luxuries include "carts and carriages for carrying persons whether or not varnished." Which means, we take it, that no amount of "polish" entitles you to a carriage-and-pair. Upholstered furniture is also included as a luxury. Tooth paste, however, is not.

IN THIS ISSUE: An Electrical Christmas for the West

JOURNAL OF ELECTRICITY

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Vol. 45, No. 9

SAN FRANCISCO, NOVEMBER 1, 1920

Per Copy, 25 Cents



Hotpoint

Electrical
Appliances

EDISON ELECTRIC APPLIANCE CO., INC.

CHICAGO

New York

Ontario, California

Atlanta

SEEN AT 3 P.M.



The above picture was taken on a sunny afternoon in a coffee-house in the center of one of our industrial districts.

This picture only shows about one-third of the men loafing that afternoon as the rest of them refused to have their picture taken.

With an E. C. & M. Lifting Magnet working for you, conditions like these will be eliminated as an E. C. & M. Magnet never strikes or lays off.

Write for Bulletin 1025



THE ELECTRIC CONTROLLER & MFG. CO.

FOR SOUTHERN CALIFORNIA:
O. E. THOMAS,
WASHINGTON BLDG., LOS ANGELES

CLEVELAND, OHIO
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W. MONTELIUS PRICE, SEATTLE, WASH.

FOR NORTHERN CALIFORNIA:
C. F. HENDERSON,
CALL BLDG., SAN FRANCISCO



JOURNAL OF ELECTRICITY

FOUNDED 1887

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H. W. L. GARDINER, Business Manager

VOLUME 45

SAN FRANCISCO, NOVEMBER 1, 1920

NUMBER 9

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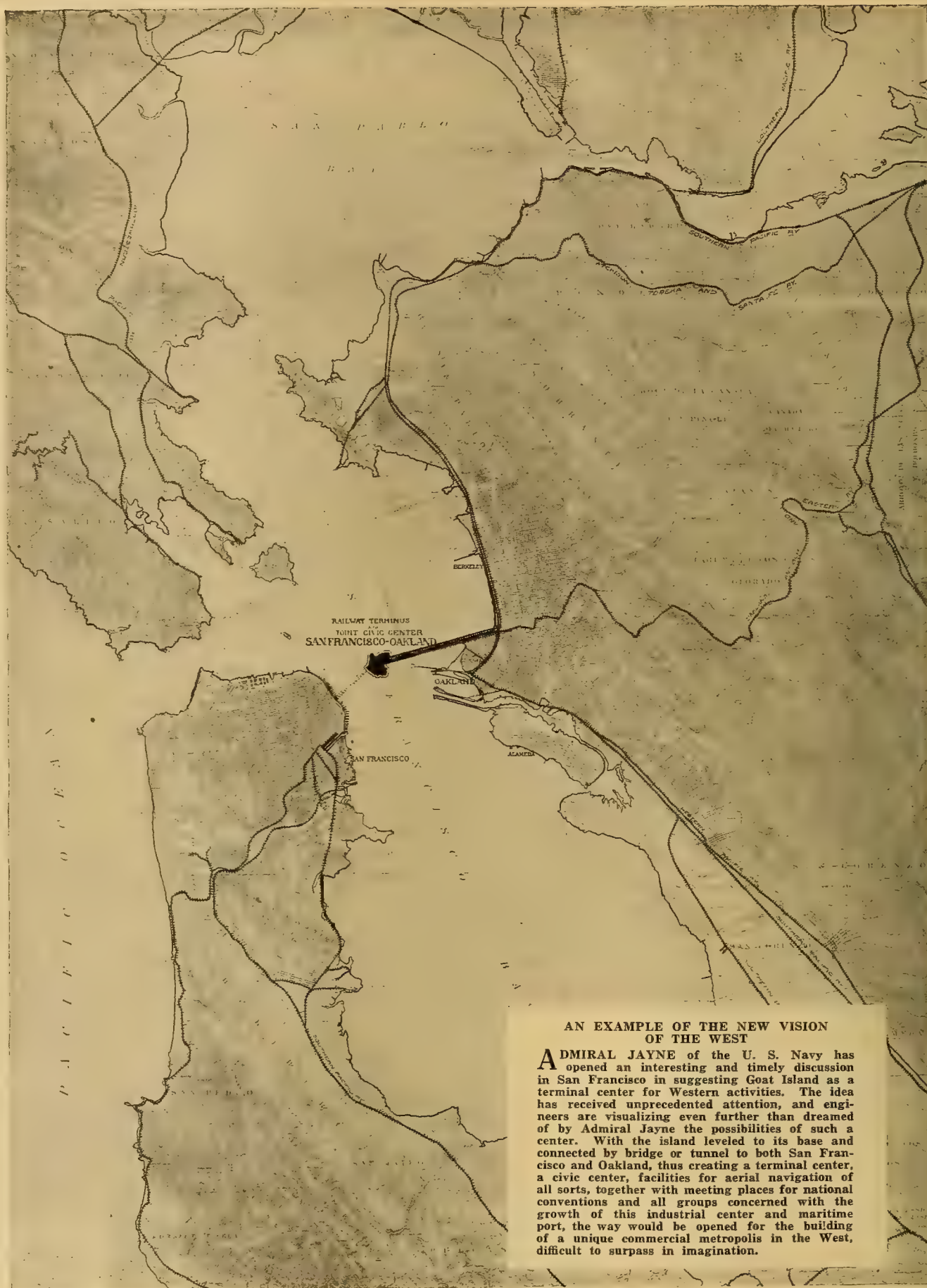
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THE ELECTRICAL TRIO:

ELECTRICAL WORLD — JOURNAL OF ELECTRICITY — ELECTRICAL MERCHANDISING



AN EXAMPLE OF THE NEW VISION OF THE WEST

ADMIRAL JAYNE of the U. S. Navy has opened an interesting and timely discussion in San Francisco in suggesting Goat Island as a terminal center for Western activities. The idea has received unprecedented attention, and engineers are visualizing even further than dreamed of by Admiral Jayne the possibilities of such a center. With the island leveled to its base and connected by bridge or tunnel to both San Francisco and Oakland, thus creating a terminal center, a civic center, facilities for aerial navigation of all sorts, together with meeting places for national conventions and all groups concerned with the growth of this industrial center and maritime port, the way would be opened for the building of a unique commercial metropolis in the West, difficult to surpass in imagination.



JOURNAL OF ELECTRICITY



DEVOTED TO THE UPBUILDING OF THE ELECTRICAL INDUSTRY IN THE WEST
AND IN THE COUNTRIES BORDERING THE GREAT PACIFIC

Volume 45

SAN FRANCISCO, NOVEMBER 1, 1920

Number 9

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SLUMP OR NO SLUMP THE WEST IS SECURE

SCARCELY three weeks have passed since Alexander T. Vogelsang, Assistant Secretary of the Interior, put before the National Convention of the Water Power League of America a vision of new industrial life of the West that is so fully in accord with the Western viewpoint that it has led a certain sense of optimism to assert itself throughout the West. Mr. Vogelsang stated that while the center of manufacturing and industrial activity is now in the East, the sources of power, coal, oil and hydroelectric energy coupled with the basic raw materials, have their center in the West. The only advantage the East has, he argues, is the labor reservoir incident to its larger population. In his allusion to the question of population, the West has felt a thrill due to the recent announcements from the Census Bureau at Washington concerning what has happened in this section during the last decade. Idaho's population has increased by 30%; Arizona leads all other states of the Union with its population increase of some 65%; California ranks next to Arizona with a population increase of 44.1%—a clean-cut million more people than it boasted ten years ago. The industrial survey reported from the census at Washington is most profoundly encouraging; the San Francisco-Oakland district, for instance, registers a population close to one million, with a manufacturing output totaling over three-quarters of a billion dollars annually. Los Angeles, too, has a growth in population and industrial activity of which the entire nation may well be proud, for she has now not only become the largest city of the Pacific Coast, but bids fair soon to be classed among America's greatest and most populous cities. With a prospect that these increases will not only be maintained during the current decade but will even be surpassed, the entire West is vibrant with possibilities of new development in industry, agriculture and the home. With hydroelectric energy as the basic supply for industry, the great electrical development of the West with its vast water powers is assured.

Utility regulating commissions throughout the nation have now been in successful operation for a sufficient number of years to make possible final conclusions on many important questions that formerly were held somewhat in doubt. One feature that has proved itself out beyond a question of a doubt is the method of appointment to these various utility commissions. In those states where utility commissioners have been elected by popular vote, glaring instances have arisen of political influence retarding the growth of utility service in such communities, and keeping the communities so served in a backward condition. Among those states that today are foremost in the matter of utility regulation, California may well be placed in the front rank. In a large measure, freedom of action of the regulatory body in that commonwealth is due principally to the fact that the commissioners serve upon appointment by the governor, the governor himself being held responsible to the people, thus fixing clean-cut responsibility for service. It would seem that these appointments might be lengthened out so as to cover a longer period than the four or five years customary in most

Appointment of Utility Commissioners

of the commissions of this kind. These commissions might well serve either for life or over a period of many years. The financial aspect of the regulatory body, too, brings out another question, namely that of remuneration. If a state hopes to retain men of the highest type, it would be well to increase the salaries of these commissioners in order that the very best talent may be acquired. A salary of \$8,000 in the commonwealth of California, for instance, is too small for the type of men and the responsibility required in a commission of such importance. But above all, direct responsibility to the government in the appointment of these commissioners is infinitely preferable to any form of direct nomination and election by the people.

9,677 electrical engineers belonged to the A. I. E. E. in 1919. The membership has greatly increased since that time and a large proportion of it will attend the 1920 convention at Salt Lake City.

HELP SALT LAKE CITY
PUT IT OVER

THE ASSET OF COMMUNITY INTEREST



When the properties of the power company come to be reckoned among the show places of the city, the object of excursions for visiting sightseers, with views of the plants sold on postcards in the drug stores, the feeling of the community in question toward its electric utility may be assumed to be friendly. The Puget Sound Power and Light Company of Bellingham, Wash., has recognized the value of this element in good will, and with the idea of more firmly cementing the cordial good feeling in its district, is arranging to make its beautiful Nooksack Falls property accessible to visitors by providing a parking place for machines off the county highway and a foot-path across its land to a specially built platform overlooking this beauty spot.

As the Christmas season draws near and is suggested by the sharpness of the morning air, there is

The Christmas Spirit in Business

the feeling that the world is after all a pretty good place and that it is good to be alive. While this is largely a physiological fact, it is well to stop and consider the psychological fact that it is possible to utilize the feeling which is predominant during this season of the year to secure better business relations with the consumers. This can be accomplished in many ways and should not be made so apparent that it will lose the effectiveness that comes from a spontaneous greeting or service. Some of the means by which this open-heartedness may be taken advantage of to make better friends of consumers are dealt with in an article appearing on another page of this issue, and one of the best ideas is to issue special instructions to all of the employees who come in contact with the consumers to be particularly courteous to them and to pass on the spirit of Christmas. Executives all up and down the line, from the president to the straw-boss, should set the example within the company so that the

entire organization will be imbued with the spirit, and the conversion of the consumer into a booster will be accomplished unconsciously, as it must be if the greatest benefit is to be derived from the campaign.

Electrical Christmas presents are already an institution, and the contractor-dealer has learned to

Electrical Toys—a Christmas Opportunity

plan for a great increase in appliance sales during the Christmas season; but in his rapid development of new ideas in merchandising he has tended to overlook one class of customers—the children. With the phenomenal increase in the demand for electrical toys, a logical place is created for the electrical retailer among those who cater to the juniors, especially at Christmas time, and dealers who have taken advantage of this condition have found the venture well repaid.

On another page of this issue are given some interesting facts and figures about toy merchandising, and its direct and indirect effect on the electrical retailer's business. Results achieved show that the advantages can be measured in dollars and cents as well as in many other ways.

Much has been said of the education of the customer, and much has been done, and is still being done, to familiarize the community at large with the electrical idea. In a few years' time the boy who owns a wireless set will own a home, and it goes without saying that he is more likely to have that home properly wired than the boy who does not know a battery from a motor. The girl who has made cookies for her dolls on a toy electric range will probably not make toast on an open fire when she starts housekeeping in earnest.

Apart from profitable sales and the education of customers, the dealer will think especially at the Christmas season of the good-will created by toy merchandising. The sale of toys provides the dealer with more outlet for his ingenuity and imagination than almost any other line, and a greater opportunity for making friends. It permits of merchandising devices which will add immeasurably to the human interest of his store, to its Christmas spirit, and consequently to its reputation as a place to buy Christmas presents. On this friendly atmosphere of service the contractor-dealer's place in the community largely depends, and no better time than Christmas can be chosen to establish it.

With sixty per cent of the industrial plants in the United States insufficiently lighted, a large field

Possibilities in the Industrial Lighting Field

of profitable business is opened to the contractor-dealer who is aggressive enough to study the needs of the industrial plants in his territory and to sell the idea to industrial plant managers that there is a direct ratio between illumination and production. The time is coming when greater and greater demands are going to be made upon the contractor-dealer for suggestions as to proper lighting, and while he should not take the

place of the consulting engineer he must be conversant with the facts that make for better lighting conditions. This means constant study and application of the latest ideas in illumination. With the N. E. L. A. taking an active part in the campaign for better lighting, assisted by the various cooperative efforts, the contractor-dealer who really desires to keep up with this end of the industry will have plenty of assistance. These facts were brought out at a recent meeting of the San Francisco Electrical Development League by J. A. Vandegrift, sales manager of the National Lamp Works of Oakland. As an example of the opportunities in the West he brought out the fact that in San Francisco alone there were thirty-five hundred industrial plants of which at least one thousand had poor lighting conditions which were retarding their output. This new business is waiting for the contractor-dealer who should make every effort to know conditions in his territory, understand industrial lighting and so add to his volume of business.

Considerable interest has been attached to the recent move of city ownership in San Francisco by which the depreciation fund of the city street railway system has been utilized to purchase bonds of the city's Hetch Hetchy water and power project, at that time in need of money to carry out its construction work. One of the evening papers in commenting favorably upon the situation argued that a "depreciation fund is merely another name for surplus," going on to point out that due to increased prices, the street railway system had not depreciated in any way since it had gone into service five years ago, but was actually worth more today than it was at that time!

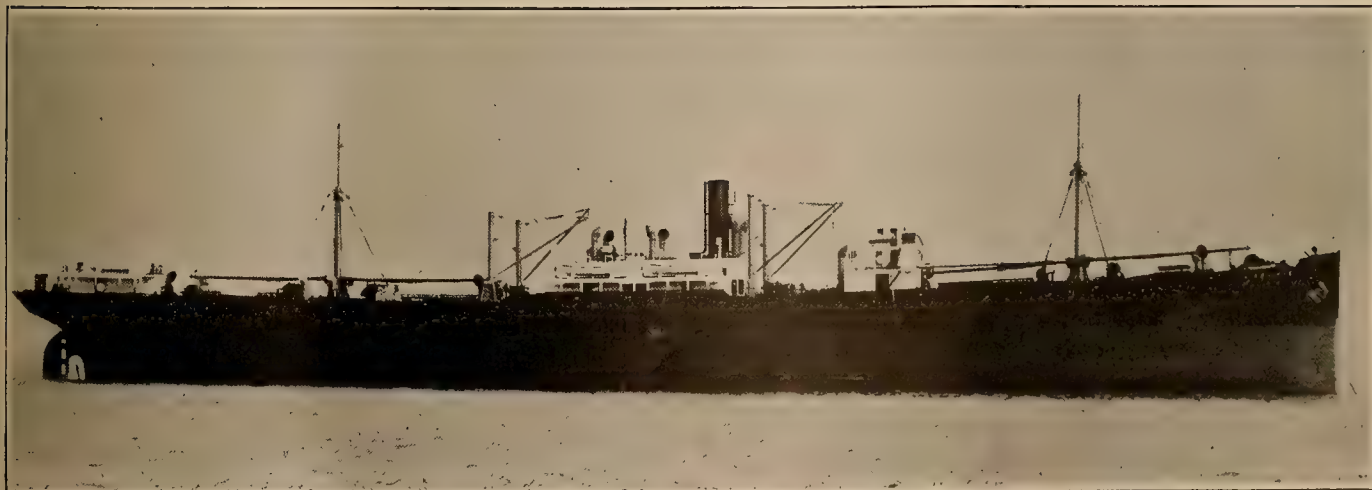
This is a shining example of the hazy conception which the public seems to hold on the subject of depreciation. The fact that the rails, road bed and cars would have to be replaced at the same or a

higher price not so many years from now did not seem to enter the writer's head. Depreciation to him evidently applied purely to the risk which might be involved in a fluctuating market, a factor which does not effect depreciation in the least, except in so far as increased prices mean that equipment must be replaced at a higher cost. The power companies of the Northwest have suggested the use of the term "deferred maintenance" as a substitute for "depreciation." This is unfortunate in a way as it suggests that maintenance has not been kept up to date. Perhaps the most accurate term is that of "replacement fund" which cannot be misunderstood even by amateur economists. At any rate, it would seem that anything which the electrical industry can do to bring the use of a simplified term into general use would be a step in the way of progress.

All restrictions on power service have now been declared off in California due to the recent plentiful rains that have visited that section. This brings to a close a most interesting situation in the West, and one in which the Journal of Electricity feels called upon to offer a word of commendation. Our readers throughout the West are familiar with the fact that due to the power shortage in California all the power companies, particularly those of northern and central California, have been greatly restricted in the use of power during the season just past, the restrictions being imposed by H. G. Butler, power administrator of the Railroad Commission of California.

One of the most interesting deductions of the power administrator's program is that of the efficacy of the skip-stop operation of the street railways. Enforcement of this plan throughout certain municipalities, especially San Francisco, proved not of great inconvenience to the public and yet at the same time the actual saving in power was marvelous. We commend Power Administrator Butler for the excellent

ELECTRIC PROPULSION FOR MERCHANT VESSELS



Electric propulsion for battleships is acknowledged a success. For some time it has been recognized that all future dreadnaughts would be electrically operated and the recent triumph of the "New Mexico" in winning the economy records in the test run has done away with any doubts as to the comparative costs of such operation. Now comes the electrically propelled general cargo merchant vessel. The S.S. "Eclipse," shown above, which is ready to be placed in active service with the American Line of the International Merchant Marine, was built by the Union Iron Works of San Francisco and is electrically operated throughout, the first of its kind to be put in operation in this country. The possibilities of this new field are yet to be explored.

and tactful way in which he handled the entire situation, and we point to the fact that once again the West has demonstrated its ability to emerge with flying colors from a situation that might have had disastrous results.

CARRYING INDUSTRIAL LIGHTING TO THE FACTORY OWNER



It is interesting to note how the subject of industrial lighting is coming to the fore in the West. The California Electrical Cooperative Campaign has within the last few days started on the installation of the permanent industrial lighting exhibit which it is establishing in San Francisco and Los Angeles for the education of electrical men and factory owners alike. A similar movement is being started in Portland and news has recently come of the appointment of a committee by the National Electric Light Association to carry the exhibit shown above, which was a feature of the Pasadena convention this spring, into all parts of the country. This interest is one of the symptoms of the industrial growth of this western country, a development which is fast taking this region into a new era of industrial prosperity.

The continued rise and prosperity of the electric range in the home brings up the subject of the distributing system for the ideal electric range load. Unquestionably the electric range is destined to play a role of increasing importance in the electrical industry throughout the West where hydroelectric energy is served by transmission systems of such unprecedented capacity and extent.

Economies of many sorts can be brought about in installation work as well as distribution work for the electric range. J. F. Farquhar at the recent Northwest Electric Light and Power Association brought out by the fact that a 40-percent saving was effected in range installation by the use of four conductor cable; while installation of this kind would not be approved in many districts of the West, still there are communities where it would undoubtedly prove of great value, and the economy is not to be doubted.

But above all, the exact balance for the range distribution service and the effect on regulation of various loads and communities served, are matters of great timely importance. D. L. Huntington, president of the Washington Water Power Company where one of the greatest developments in the use of the electric range has taken place, stated at this convention that the diversity factor brought about in the use of the electric range is far better than was at first anticipated. W. R. Putnam, general manager of the Idaho Power Company, who had so much to do with the authoritative data now incorporated in the publication of the N. E. L. A. on the

subject of the electric range, brought out the fact that the four-cent rate may be economically applied in many places for the sale of energy to the electric range consumer, while Markham Cheever, chief engineer of the Utah Power & Light Company, showed how by the use of the double throw switch for the electric range and water heater, the connected load may be kept at a minimum.

To tie in with this discussion of range installation there should be more information on the best type of distribution system required. Now is the time when engineers should be consulted in gathering definite and conclusive data on this important subject of the distribution system best adapted to the economic use of the electric range load.

The announcement of the Pacific Gas & Electric Company that at its Fall River Power Plant on the

World Records Soon to Be Broken

Pit River development there are to be installed two 40,000-hp. vertical turbine units of over 400-ft. head is extremely interesting in that these turbines will constitute the largest installation of this nature thus far accomplished, the giant units at Niagara being at the present time 37,500 hp. The year 1921 bids fair to be one which will see many records broken in the West. By that time the Kern River No. 3 power plant of the Southern California Edison Company which is installing Pelton Francis reaction type turbines of over 800-ft. drop will be in operation, thus breaking a world's record in this type of turbine. During February of 1921 the Caribou Plant of the Great Western Power Company will be put into operation, with a high-voltage line of 165,000 volts, surpassing any previous record in transmission of this nature ever undertaken. Later on in the year unquestionably either the Big Creek development of the Southern California Edison Company or the Fall River development of the Pacific Gas & Electric Company will have the distinction of breaking again a world's record by raising voltage transmission to 220,000; transformers carrying this high voltage are now being manufactured for these installations. Finally, coupled with all this power development is the giant interconnection that will be completed about January first between the San Joaquin Light & Power Corporation and the Pacific Gas & Electric network, whereby the Kerckhoff Plant will be tied in by 110,000-volt transmission lines to the Pacific Gas & Electric Company's system at Merced, thus making possible the delivery of large blocks of power to any part of California. This was touched upon in an editorial in the last issue of the Journal of Electricity.

Eastern men of the industry will get some conception of this new feat when they understand that blocks of power, through line capacity of at least 12,500 kw., can be transferred over distances equaling that from New York to Omaha, a distance of 1400 miles. Each day brings to light new and interesting records in the West of which these are the forerunners. The insistent demand for power throughout California, with fuel oil production in-

sufficient to supply the demands in steam auxiliary service, is leading the vision of the engineer to embrace even greater and more insurmountable obstacles in the matter of the harnessing of our water powers in the West.

Those who have been watching the signs of the times have been interested in following the recent development of the chain store movement and its present tendency to enter the electrical field. Eastern cities are more familiar than the West with the chain store, the example of Woolworth having been already followed there by others. The same idea is now being carried into the electrical field. One corporation has recently undertaken a campaign of national advertising in the Saturday Evening Post, the first of the series being devoted to electrical fittings and the convenience of the chain store as a source of their supply. These stores, of course, would handle appliances and fittings on such a large scale that they would deal direct with the manufacturer—it is stated, indeed, that one of the larger manufacturers has been approached by such a company on the basis of taking over the entire factory output along certain appliance lines. It is obvious that these stores will not be confined to the 15c limit, but will operate along similar lines of underselling and fixed prices at a higher level.

There is no question but that the chain store is to be reckoned with as a factor in electrical merchandising the country over, an element whose competition along certain lines will be difficult to meet. There is no reason to be especially pessimistic over this fact, however. The five and ten-cent store has not put the general merchandise store out of business, nor—a fact which is even more significant—has the United Cigar Store competition wiped out the independent cigar store. The reason is, of course, that the public finds that it gets a special service from the independent establishment which is not possible in the mechanics of a chain store management.

The same line of reasoning will obtain for the electrical store—and indeed, the cooperative movements for better merchandising which are now under way in California, in the Northwest and Intermountain district and in British Columbia are the finest safeguards in the world for the electrical merchant. For the dealer whose store has nothing distinctive about it and whose methods of business are slipshod, the announcement of a chain store in every city district and even in smaller communities selling electrical goods at a price somewhat under his own, must come as a warning of another hazard in an already precarious future. The dealer who is in step with progress, however, and who has the safeguard of a clientele built upon a record of service rendered, has little to fear from this competition. The new movement is but another spur to the encouragement of efficient merchandising.

The long drawn out questionnaire has proved the bugaboo of many an engineer's existence. The one lesson we learn from this is that questionnaires being sent out to the various power companies and engineers for tabulated data should be limited in number. Yet it must be admitted that the most authoritative work that has been accomplished through technical journals and through the National Electric Light Association, the American Institute of Electrical Engineers, and other organizations devoted to the upbuilding of the industry, has been accomplished through the questionnaire. President Elliot of Harvard once said that there were three great rules that went for success in life and they are, patience, patience, patience. So it must be ever with the questionnaire. With careful thought the number of questions to be answered may be limited, and the labor thus saved in compilation becomes of considerable moment. The questionnaire is an invaluable instrument in the upbuilding of our industry and it must stand.

A New Journal Service

WITH this issue the Journal of Electricity inaugurates an enlarged editorial policy. The first few pages of the magazine constitute the most important contribution which its editors can make—they express the aims of the paper and carry the full weight of its influence in furthering those elements in Western thought which it believes to stand for the best in the electrical industry. It is felt that with the greater space allowed this department beginning with this issue and the addition of pictorial editorials, the Journal of Electricity can the better fulfill its aim of taking the lead in formulating Western opinion, as well as presenting a more complete review and commentary upon all that is significant in the nation's events from the Western point of view.

The Children's Christmas Electrical

(New ideas and new methods in the retail field have been among the conspicuous features of electrical progress during the past few years. The following article takes up the possibilities of electrical toys, an appropriate and profitable Christmas line which at present is but seldom handled by the electrical dealer.—The Editor.)

CHRISTMAS stands for a good many things, but to over twenty-four million children in the United States it means toys—everything from Teddy Bears to airplanes that Santa Claus manufactures at the North Pole workshop. The electrical dealer, with all his catering to the demands of the home, has not yet fully realized the possibilities of this immense market. Selling Aladdin's lamp to the housewife, he has often overlooked his opportunity of playing miracle-man to the junior members of the family.

The demand for toys is on the increase, and the present annual production in the United States has a wholesale value of \$35,000,000, with a growing proportion of educational toys. Among these, electrical toys are becoming increasingly important, as shown by the fact that the call for toy motors has trebled in the last year. The drum and the tin whistle, which amuse for an hour and then are relegated to the obscurity of the playroom closet, no longer satisfy either parent or children. The boy of today wants something which 'goes'; something to make; something which he can tinker and repair and adjust, and show off to his school mates. And if it 'goes by electricity,' then indeed he is a demigod among the mere mortals who wind up their trains with a key. Complacent parents look on with the satisfied feeling that the boy is 'learning something'—though more often a father is crawling round the floor himself. Perhaps the appeal of electrical toys to grown-up children is one of their secrets. Most fathers are not entirely disinterested in buying an electric train, and prefer it to a drum for other reasons than those stated.

The variety of electrical toys on the market this year is wider than ever. Besides electric trains and wireless outfits, there are caterpillar tanks that crawl serenely over boxes and piles of blocks; electric automobiles



The illuminated Christmas tree is an integral part of Christmas. In the dealer's window why not combine it with electrical toys?

and boats; construction sets with which the budding engineer may construct his own motor and other apparatus; telephone sets; motion picture machines; electric dancers, and miniature electric ranges for the small girl with a large family of hungry dolls. There are many other toys which properly come within the sphere of the electrical dealer, to say nothing of Christmas tree lighting sets, and all sorts of novelties for Christmas tree decoration. A recent estimate of anticipated Christmas tree lighting sales gives \$16,000,000 as the figure for 1920.

It is a mistaken idea that even now this great volume of Christmas business is handled exclusively by toy stores and department stores, though about 75 per cent of the business still goes through these channels. A hardware store in the Northwest records sales of toys amounting to \$100,000 in a single year, many of the toys being, of course, electrical. If the hardware store, why not the electrical store? Figures

show that the demand by electrical dealers has doubled this year, but numbers of them still hesitate to take up this line. A considerable demand is noticed, however, as coming from dealers in small towns and country districts where department stores are not in evidence.

The Christmas season is the great opportunity for the electrical dealer. Moreover, for the sale of electrical toys he has special advantages. In the first place his customers are largely home-makers and therefore usually concerned with children. Also they are people whose houses are wired for electricity, and who are 'sold' to a greater or lesser degree on the electrical idea. They do not have to be introduced to electricity; they have a certain familiarity with it, and they are not likely to think of it as a mysterious and dangerous plaything for children. They are the kind of people to whom electrical toys may



most logically and easily be sold. Moreover, the electrical dealer has the prestige of being 'an electrical man,' and therefore qualified to explain and sell electrical toys. Boy customers are liable to have more confidence in him than in a department store saleslady, and to come to him for advice and repairs.

Handling a Toy Stock

Dealers who handle electrical toys are enthusiastic about them. One Western dealer who always carries a large and varied stock of electrical toys for Christmas, states that during this season his toy sales amount to more than his sales of appliances. When one considers that a \$20 electric train can often be sold with far less selling effort than an \$8 electric iron, this is not hard to understand.

This same dealer, moreover, finds that it is not necessary, as some have thought, to carry other kinds of toys in order to attract trade. Customers come in specifically for electrical toys. To meet the expected demand this season he has laid in a stock larger by about 50 per cent than that of last year, with a total retail value of \$3,000. At the close of last season he had not more than one item of any one kind of toy left over—amounting to about one-half of one per cent of his stock. There is occasional demand for the toys at other seasons of the year, but he does not count on any but the Christmas season.

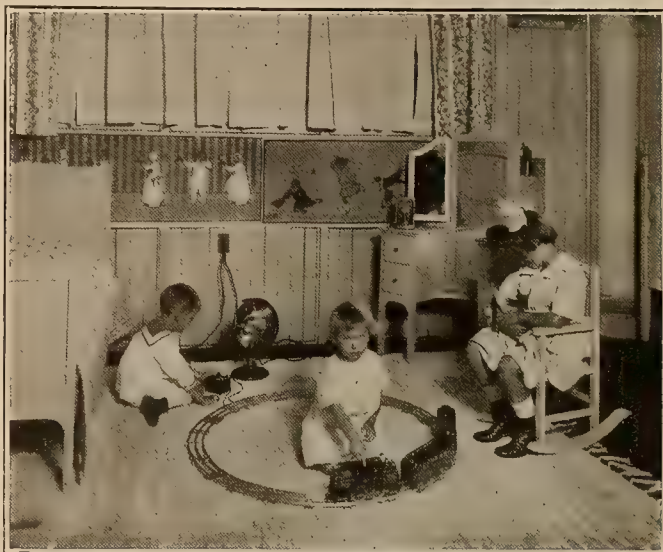
Though toys can usually be obtained from the toy jobber, it is necessary to order very early in the year for shipment from the factory. When this year delivery was made to a dealer in June, the electric trains were put on display at once, both in the window and inside the store. It was found that an electric train in operation was one of the cheapest and most effective window displays for any time of the year. The movement attracts attention, and the train is not injured for selling purposes. Moreover, parents shopping for appliances make a mental note of these displays, and remember them when Christmas time comes around. Youngsters shopping with their mothers also make a note of them, and also remember them when Christmas time comes. An electric train window display has collected enough of a crowd to cause a serious obstruction of the sidewalk.

One dealer has found electric trains to be without question the best seller among electrical toys. They range in price from about \$9 to \$75, but those above \$40 appear to have only a limited sale in the electrical dealer's store. The sale of this type of electrical toy of course always carries with it the sale of a toy transformer. The trains run mostly on from 7 to 15 volts. In addition to the toy transformer, extra tracks and switches are usually sold, and various other accessories such as signals. If these are not bought originally, they are usually added shortly afterwards, or included among Christmas purchases the following year. Extensions to his railway system will generally please the small boy as much or more than a new toy, a fact which often solves the Christmas present problem for parents, as the possibilities are practically unlimited. The current consumption of the toys is of course negligible.

Another excellent seller, according to a dealer who knows, is the electrical construction set. The stock carried, however, must depend entirely upon the individual business, both as to variety and quantity.

Methods of the Department Store

The experience of department stores is slightly different from that of electrical dealers. These record a fairly steady demand for electrical toys throughout the year, though of course a much greater demand at Christmas time. A large Western department store having a very fully equipped



Both parents and children are demanding toys which have more than a momentary appeal, and electrical toys are becoming more and more popular for children of all ages.

toy department, and specializing in electrical and mechanical toys, finds wireless sets the most popular of all. Two wireless receiving stations have been set up, connected with an aerial on the roof. One of these is a miniature of a wireless room on an ocean liner, painted gray, and surmounted with miniature wireless towers with colored lights. Here ecstatic small boys listen in on the dot-and-dash conversations from the ships and government stations within range, with an air as important and business-like as if they understood every word.

This store maintains a special repair department and gives very thorough service on its toys, thereby making fast friends and getting some of the best kind of advertising it is possible to have. During the Christmas season, advertisements are run in the newspapers announcing special demonstrations, and a Saturday afternoon story-hour. The audiences at these affairs invariably explore the wonders of the toy department, carrying willing or reluctant parents

70,000 new homes are needed in Washington at the present time. Possible outlet installations, if each of these homes is properly electrified, will amount to \$7,000,000 in business to the electrical contractors of Washington.

**HELP THE NORTHWEST ELECTRICAL
SERVICE LEAGUE PUT IT OVER**

with them, and doing as much advertising of the charms of moving toys in five minutes as some other publicity methods do in five weeks.

Building for Christmas Business

The idea of a wireless receiving station is one which could easily be worked out with but little expense by the electrical store. The news of such an installation spreads like wildfire in any neighbor-



A new Christmas tree lighting set is wired in multiple so that the burning out of one lamp does not spoil the tree.

hood where there are boys, and the enterprising dealer is likely to find himself a center of attraction with surprising rapidity.

Many electrical stores have sufficient space to fit up a special section for toys, where the various models can be connected and operated at any moment. The working toys are their own best salesmen, and call for but little sales effort. A toy department presided over by a benign Santa Claus has been tried out with great success. An illuminated Christmas tree is an effective addition.

The possibilities for window displays are among the chief charm of electrical toys. The train in operation has already been referred to. A beautifully decorated Christmas tree with colored electric lights has long been a favorite night display, and if supplemented by a few electrical toys will put the electrical dealer in a different class from "the store that sells the vacuum cleaners," as far as his small future customers are concerned.

Another appropriate Christmas display is the doll's tea party, with miniature electric ranges. Dolls can be used to great advantage with all kinds of electrical toy displays, and have a human interest appeal which never fails to attract attention.

Numerous publicity devices can be used to appeal to children—contests of various kinds, for in-

stance. The dealer will always find his popularity with his junior clientele is not only a pleasant but a profitable side to his business. Children who bring up their parents correctly have considerable influence on their decisions, and the dealer who has done repairs for, and given advice to, the young wireless enthusiast, is pretty sure to be given a strong recommendation when the household wants a new toaster. The Christmas toy business has its influence on sales of appliances throughout the year.

The Christmas Electrical is not a new idea. Why not extend it to the children?

CUSTOMERS' COMMENTS

(How distinctly the woman shopper is influenced by the appearance and atmosphere of the store she patronizes is told here from the customer's point of view, and emphasizes the fact that business is as dependent as other phases of existence upon intangible amenities.—The Editor.)

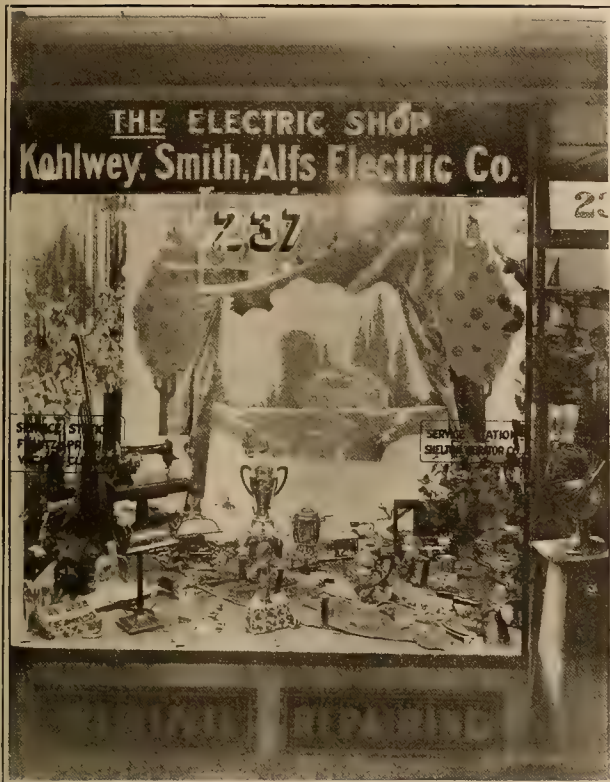
The electrical shop is like the automobile service station in that it handles standardized goods and must, therefore, draw any unusual trade by means of shop atmosphere rather than because of any price competition. For example, in visiting a number of shops in Oakland, I found each one asking the same price for a certain electric toaster. There was no element of price competition. How, then, is any one shop to draw more trade than the others? Most certainly by displaying and presenting its goods more attractively than the goods of its competitors; by developing an unusual shop atmosphere.

In a certain shopping centre there are two electrical stores, situated side by side. They illustrate what I mean by a difference in shop atmosphere. Upon entering the former, one is somewhat distracted and depressed. First, the store is dark—a condition rather incongruous and unnecessary in an electrical shop. Then, gas and electrical appliances of every kind overcrowd the store. No one article, or sort of articles, is allowed to stand out from the rest. Lamps, unlighted, are placed so close together that no one is distinguished from its neighbors. And then, in keeping with this shop atmosphere, I found that the clerk showing no enthusiasm over his goods. He volunteered no unnecessary information about the toaster which I looked at, and really seemed a bit more pleased to see me leave than to see me come.

I stepped into the neighboring establishment. The glow from a number of lighted lamps on display was delightful. Such articles as grills and toasters glistened in the show cases. They appeared more like jewelry store material than like a sort of hardware. A woman clerk made me feel that the toasters she presented were the best on the market and that she, personally, was immensely interested in these particular articles. Naturally, I am going to "call again."

At the time of my visit, the second company was handling more customers than its neighbor. The quality and price of the goods in the two stores is too much alike to account for any difference in trade. The former is commanding patronage solely because of its pleasing service and shop atmosphere.

Christmas Windows



Brilliant and cheerful coloring—red, orange, blues and greens,—characterized the Christmas window of Kohlwey-Smith Electric Company, S. F. In the snowy background a small Santa Claus drove his sleigh swiftly down an incline and up the other side. Two Santas were provided so that too long an interval should not elapse between appearances.



An effective Christmas window in red, green and white distinguished the store of J. C. Hobrecht, Sacramento, California.



O. F. Abbott, Hanford, California, set off his Christmas display against a snowy white glitter, with touches of holly.



The awning outside the store of the Valley Electrical Supply Company, Fresno, California, was converted into a green bower with redwood boughs, and colored lights were strung in the foliage. In the window a toy electric train in operation, and two fountains and two lakes connected by a miniature river of running water attracted a great deal of attention.



A loaded Christmas tree, beautifully lighted, brought the Christmas spirit to the Utah Power & Light Company's "Electric Shop."

The Central Station and Christmas Service

(Originally the word 'company' meant a band of companions held together by a common cause. At the present time the word 'company' has come to have a different meaning, but that is no reason why the original meaning of the word should be forgotten. The results of a questionnaire sent out to the power companies of the West are listed below, and brought out in the following article which contains suggestions for bettering the relationship between company heads, employes and consumers during the Christmas season.—The Editor.)

The fact that power companies are generally classified in the mind of the consumer with other soulless corporations is the fault of the power companies themselves as well as their consumers. A power company or any other corporation is not a soulless thing but is a composite of many souls, each of which is a part of the whole and each of which is liable to be the standard by which the soul of the corporation is measured by the consumer. That this fact is recognized by the majority of the managers of the large power companies is apparent when it is known that at a recent meeting of the public relations committee of the National Electric Light Association the three most important matters brought up for discussion were, the relation between the company and the consumer, the relation between the company and its employes, and the relation between the companies themselves. The first two of these subjects are directly concerned with service, and just that much more intimately connected with the extra service that should be given during the holiday season.

In the belief that service is one of the biggest assets that a power company can have, a questionnaire was sent out to the largest power companies in the West and some of the smaller ones, to find out what efforts were being made to capitalize on the receptivity of the consumer's mind at the Christmas season. For at that period of the year one hesitates to play "Old Scrooge" and it is the ideal season to do some good deeds that will soften the wrath of the consumer for the rest of the year to come. For the purpose of comparison the soul of the power company is represented by the answers to the questionnaires that were received; especially the answers to the two questions, "What form of gift, good wishes, or advertising have you given the consumer during the Christmas season?" and "What gifts, bonuses or entertainments have you given to your employes during the Christmas season? This should include gifts, dances, plays, bonuses, etc." Some had good deeds in the past to boast of, some made excuses for not having done more, and some probably muttered to themselves "Bosh," the exact word of old Scrooge, and wrote down, "None."

The first two questions asked had to do with the

cooperation with contractor-dealers in pushing the sale of electric appliances for Christmas presents. Since this is the day of cooperation in the industry the answers were all practically the same; that by advertisements in the newspapers, by window displays, by stuffers in bills, and by car cards they have suggested to their consumers that the smaller electrical appliances make ideal Christmas gifts. That is of course done from the self-interest standpoint as the returns from the sale of appliances are going to increase the customer's bills, but the increase of good will of employes and consumers in most cases seems to have been forgotten.

The smaller power companies seem to excel in rendering Christmas service, which is probably due to the fact that the head of the company is closer to all the employes and understands them better. Consequently he can understand their needs, and by treating each individual case can assure each member of the company in person of his interest.

Of course, the manager of the company is not to blame in each case as he is directly responsible to a board of directors and a finance committee, so for the benefit of these worthy gentlemen who probably do not know one per cent of the employes in their respective companies, let us put the whole case in dollars and cents. Money talks in this case, and as they feel responsible to the stockholders for each cent of money expended, let us for a minute forget the altruistic side of making a real true Christmas spirit exist in the hearts of consumers and employes, and figure out on the self-interest basis just why they should do this thing from a financial point of view.

The Christmas Bonus

A practice employed by some of the largest corporations in the country is to give a bonus at Christmas time to all employes who have been in the employ of that company for a certain length of time. This plan has its disadvantages, but at least the money thus expended does not have to be given to the government as it may be counted as a gift or as salaries. Just before Christmas there are several of us who are figuring just where the money is to come from to buy the doll or drum desired by the lord or lady of our household. For the salaried man

THE QUESTIONNAIRE

1. What efforts has your company made in the past to assist the contractor-dealer in the sale of appliances for Christmas presents? This should include advertising, demonstrations, exhibits, etc.
2. What plans have you for this year?
3. What form of gifts, good wishes, or advertising have you given the consumer during the Christmas season? This should include calendars, blotters, etc.
4. What are you planning along this line for the coming Christmas?
5. What gifts, bonuses or entertainments have you given your employes during the Christmas season? This should include dances, plays, bonuses, etc.
6. What are your plans along this line for this Christmas?
7. Have you given any special instructions to your employes about Christmas time to spread the message of "Good Will to Men" toward the consumers during the Christmas season?

this bonus would only be a slight recompense for the many hours of overtime which he has given to the company cheerfully throughout the year without any thought of reward except that of clear conscience for a job well done.

Then let us take the idea of a small useful gift such as an "Eversharp" pencil for each employe. This is surely a gift, and can be deducted from the income tax return which must be given to the government next March. A little thing! Yes, it is, but nevertheless every time that the employe uses that pencil during the next year he is going to think of the donor, and that thought is going to be one of appreciation.

One company gave insurance to its employes for a Christmas gift a few years ago and every Christmas since then has paid the premium on that insurance for the employe. That is a fine idea, but how is the employe notified that his premium has been paid? Is a receipted bill sent him or a brief business letter on company stationery, stating that the premium has been paid and will Mr. Smith please acknowledge receipt of the same with thanks? If so, then that particular company has lost a big opportunity to make the gift more effective. If the manager of that company has put that particular message of the paid premium on an engraved card with a cheery Christmas greeting, asking the employe to accept the receipt for his insurance as a slight appreciation by the company of the loyalty he had shown during the year, the spirit of giving has gone along with it and made the gift more effective.

Company Celebrations

A certain company decided to celebrate Christmas in the proper way and so the members of the office employes' association of that company all chipped in and gathered about two hundred and fifty dollars together and with it bought presents for their children and gave themselves a party at which they danced and had a tree for the children. This is all right, but the fact that an association of employes giving a party in the name of the company had to provide their own wherewithal, should have made it a rather peculiar Christmas for the members of the finance board, especially if they attended the party; and they were all invited. Even if the company were on the wrong side of the ledger, the stockholders would not have begrudged that two hundred and fifty dollars to the employes for a Christmas party. It might well have been charged to additions and betterments; additions to loyalty and betterment to esprit de corps.

The Company Christmas Summarized

Summarizing the answers to the questionnaires: twenty-five letters were sent out: thirteen were answered: of the thirteen answers to the two questions given above six read "None" and two of these defended themselves on the ground that "their employes were paid better than the average." One company had taken out insurance for its employes, one had given a party with a tree and presents for the "kiddies," and one had sent Christmas greetings to its consumers by means of an advertisement in the newspapers.

Of the remaining three one had sent some small, inexpensive but useful present to each employe, combined with a dinner at which the officers and men of the company got closer together, and a card to each consumer (and while this company is not in the best financial condition its employes own stock and are one hundred per cent for the company). Another had been in the habit of giving a turkey and a basket of delicacies to each employe but due to the high prices of foodstuffs had been forced to abandon this idea for a less ambitious schedule. The third company through its employes' association had given a big entertainment and dance which was repeated in several parts of the wide territory covered by this company so that all of the members of the association might have an opportunity to participate in the spirit of the festivities.

Creating the Christmas Spirit

A small gift, not necessarily money, at this time of the year will do more towards cementing the bond between employer and employe than all of the "good will men" who are sometimes employed for this purpose. And the salaries paid them for one year, judiciously expended at this time will accomplish more than they could in double the time. For the company that can afford to spend money on individual gifts there are many ways of bringing about the desired result. Let the "big boss" take the afternoon before Christmas off and visit his department heads and as many others as he can reach and wish them the good old-fashioned "Merry Christmas" with a smile and good stiff hand-shake. Let the department heads do the same and all the way down the line to the "straw boss," so that each employe of the company is sent home on Christmas eve in the right spirit. Do the employes get paid on the twenty-fifth of each month? Then when they are paid the day before Christmas, have some little stickers made up in bright colors with a sprig of holly on them and a cheery message of Christmas greetings from the company. Are all of the district offices tied in with the head office by telephone? Then have the operator get them all on the line at once just before closing time and wish all of them the good old wish from the head office represented by the general manager, or better yet, the president. Tell them to pass the good word along. Let the married men off at three o'clock the day before Christmas so they can get in some shopping with their wives before the stores are stripped clean. Or let them have an extra hour off for lunch the week before Christmas so that they can do their shopping. If there are any promotions or raises in salary to be made during December, save them until

50,000,000 acres of land in Colorado are over 5,000 ft. in altitude. A great part of the farming lands receive irrigation and domestic water through electric pumping. Colorado's growth is in large measure dependent upon the development of its abundant water powers.

HELP COLORADO
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the twenty-fourth and send the party a little note to be opened the next morning, telling him of the raise, and that it is retroactive. If there are any promotions to be made at the first of the year, send the same note telling him of the fact. And if an employe is to be dismissed, save the blow until after Christmas so that he may be happy on that one day, even if he is going to be out of a job for the next year.

Including the Customer

Have the customers seemed unappreciative of the excellent service rendered during the past year? Remember that every public utility is the servant of the people and do you take the service given to the company by the employes who are under your charge as granted, and figure that is what you are paying them for? That is the way that the public regard the power company. If you want your employe to wish you well on Christmas day you exchange greetings with him, and you like to have him initiate the greetings. It is exactly the same with the intangible, soulless power company. Send out an engraved Christmas card to each of your consumers and the day he receives it, if it is nicely worded and distinctive, he will wish you well, and some of that is going to stay with him and cut down the cost of running the complaint department. A card stating that on account of the season of the year and recognizing the fact that at this time of the year you need some extra pin money, therefore December bills will not be due until January. True that the interest on that amount of money outstanding is considerable, but the uncollectible account column would be less in the next six months, for that courtesy would be recognized by some who might otherwise be inclined to let their account slide.

See that special notice is given to each employe who comes in contact with the public, that during the week before Christmas he must pay unusual attention to the wants of the consumers, that he must take advantage of the open-heartedness of the consumer at this time of the year, and slip into that consumer's heart a greater appreciation of the company and what it is doing. The day before Christmas each employe should be instructed to wish each consumer with whom he comes in contact, the old wish, not perfunctorily but with a whole heart. Instruct the telephone operator and the complaint men that on Christmas day they must thank each consumer for being able to be of service and pass on the message, of "good will to men." Let the telephone operator on Christmas day add a "Merry Christmas" to her "Hello" when she answers the incoming calls.

A Profitable Investment

The results from such service rendered to the employe and consumer can not be directly appraised but it is safe to say that the extra efforts and loyalty it will bring from employes and the added consideration, toleration and thoughtfulness it will bring on the part of the consumer will more than pay the interest on the money so invested. This is the day of cooperation in the industry and when the employer has studied cooperation between the branches of the

industry and seen the results obtained he can not help but believe that some of this same cooperation between himself and his employes and consumers of the company, will bring even greater results and the satisfaction in knowing that he is rendering toward them what he preaches to them, "Service."

TENNIS AT NIGHT

BY I. E. VOYER

(An illumination engineer with the San Francisco office of the General Electric Company tells here how the tennis courts at Golden Gate Park are so well illuminated that players of considerable reputation say they can play faster tennis under this system than during daylight.—The Editor.)

Tennis for years has been one of California's most popular out-of-doors sports. During the past four years because of the high cost of labor and materials insufficient new courts have been added to take care of the natural increase in population and the new people attracted to this sport, and of late ways and means are being sought to increase the capacity of the now overcrowded courts. Those interested in the development of outdoor illumination have been looking to the time when this science should come to the aid of the tennis player.

The real tryout has come with the standard overhead Mazda installation on two of the public courts in Golden Gate Park, San Francisco. It is the intention to give this installation a thorough tryout, and if night tennis playing becomes popular with the public, the other eighteen asphalt courts in the Golden Gate Park group will be similarly lighted.

The accompanying photograph shows the courts in use. Each court has four 1000-watt Edison Mazda lamps, equipped with Ivanhoe BEE 1000 metal reflectors mounted thirty feet above the playing surface, and suspended from steel messenger cables supported by guyed wooden poles. The service is carried to the lamps through a keylock switch mounted on the poles located at one end of the court. By means of this either or both courts may be lighted by the author-



Professionals who have played on these courts state that they are better able to gauge the flight of the ball and to more accurately time their strokes because of the constant shadows produced by the fixed position of the overhead lights.

ized person in possession of the locking key. The courts are open to the public, and are being patronized principally by those who must work during the day.

The courts were officially opened for night playing by an exhibition match under the auspices of the Golden Gate Park Tennis Club, between Marvin Griffin, former State singles champion, and Roland Roberts, Pacific Coast champion for 1919. Roberts is one of the hardest hitting tennis players in the game today, and the outstanding feature of the match was the apparent ease with which Griffin handled his cannon-ball serves and drives under the light of the four 1000-watt lamps. Commenting on the lighting after the game, both players expressed satisfaction with the quality of light and the absence of disconcerting glare. They further stated that

they were able to gauge the flight of the ball and time their strokes accurately because of the constant shadows produced by the fixed position of the overhead lights. Other players of considerable reputation who have played under the overhead system have said that they could play faster tennis under this system than during daylight, because of the constant direction of the shadows.

The lighting of tennis courts and recreation parks for handball, basketball and other games of that nature, not only offers an excellent field for an additional lighting load for the central station and lighting equipment business, but is a good publicity agent for popularizing artificial lighting among the general public. A start may be hard to make, but additions come with less effort.

The Electric Appliance Dealer and His Future

BY C. A. PARMELEE

(Every day it is becoming more evident that business advancement in this country depends upon the development of hydroelectric power. The necessity of this development to the electrical contractor-dealer is the main point in this comprehensive discussion by the vice-president and general manager of Dohrmann Commercial Company.—The Editor.)

World-conditions during the past six years have caused a scarcity of coal which has caused prices to advance until, in many places, they are almost prohibitive. This excessive cost and small supply of fuel has dangerously hampered industry. Nevertheless the black cloud is beginning to show its silver lining. The solution is "white coal" developed by water power.

The last session of Congress put in motion legislation which will make possible the development of millions of horsepower of electric energy which can be carried to a large part of our population. We read of similar action being taken in Italy, Switzerland, and other parts of the world. Billions of dollars will be spent during the next ten years to develop these plans.

Future for Electrical Dealers —

A careful survey of the above facts should give the electrical dealer great confidence in the future of his business. Every home should be a live prospect for electrical household appliances. The scarcity of domestic help is creating an ever-increasing demand for labor saving devices. The simplicity and efficiency of these devices appeal to all, especially the housewife. The desire to possess is being created and intensified by judicious advertising and numberless articles which are appearing in popular magazines.

Under date of October 9, the International News Service sent out the following, which appeared in our dailies as a news item:

WORKLESS AGE FOR WOMEN DAWNS WITH ELECTRICITY

NEW YORK, Oct. 8.—If the craze for making things go by electricity keeps up, here are some of the things bound to happen:

Women left without work of any kind.

The housewife judged not by the way she keeps her house but by the way she oils her motors.

The feminine touch lost in home making.

Business offices operated by turning a switch.

A visit today to the latest electrical show has convinced one that feminine working stock is very much on the decline. There is no bit of labor in or about the home for which some shiny and efficient looking device is not shown.

Time for Scientific Merchandising —

The electric appliance business has passed the experimental stage; we know many things that we formerly hoped for or believed. But because the going is a little easier, there is no reason why the electrical dealers should settle back into what may be a fool's paradise. Much of the educational work has been done by the electrical man and as the appliance business becomes standardized and staple, it is much easier for the general store to handle than formerly.

The electrical dealer should recognize that his competition is just beginning—and in order to hold his own he must not only admit that he has a competitor, but study this competitor's methods and copy his strong points. Of these methods and principles a few can be listed here that are vital and come near embracing all the essentials necessary to success. What does the department-store manager know, for instance at all times?

1. Value of stock on hand.
2. Sales, daily and monthly, which are arranged to show turnover.
3. Rate of gross profit by percent.
4. Actual expense, and this shown in percent on sales.
5. Expense divided as to main items such as Rent, Salary, Advertising, Interest, etc., showing exactly what it is costing in percent of expense on each of these and many other important items.

A dealer who is fortified with the above information can go forward in confidence; if making money he knows it and can plan expansion; if losing,

1,000,000,000,000 board feet of timber are estimated to be standing in Oregon, Washington and Idaho today, giving opportunity for a tremendous development in the manufacture of wood products, already a foremost industry in the Northwest.

HELP THE NORTHWEST
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he knows it and can get busy to correct the fault. A vast number of failures and only ordinary successes can be traced primarily to the lack of knowledge of the dealer of his own business, caused by faulty accounting, or, frequently, to utter lack of accounting.

What the Jewelers Have Learned —

The retail jewelers of America have had the reputation of being a most unbusiness-like set of merchants. Their marked successes were few, their failures many. Often a small jeweler would carry a stock entirely out of proportion to his sales; being a repair man, he would spend much time on repair work, which would help greatly in meeting the daily bills; would neglect his stock, get behind in his accounts and pay little attention to turnover; had no system of accounting, did not know whether he was making money or losing. About ten years ago an active campaign was put on in organizing jewelers of all states into associations. These state associations combined and made a strong national association which today has thousands of members. Through co-operation, meetings, conventions, and able work

of their officers, a systematic campaign of education has been carried on until today a generally uniform system of education has been adopted. The jeweler is becoming an educated merchant. He knows what gross profit he should make, knows what expense means, and that he should draw a fixed salary which is a part of expense; that proper rent should be charged even when the building is owned by himself, and a score of other things he did not know before.

Recently through the efforts of a national field officer and the research work of Harvard University, statistics have been gathered from thousands of jewelers, showing the average expense of doing business in the retail jewelry trade. This valuable information plus a greatly increased gross profit, due to cooperative effort and education, is making the retail jeweler a much better merchant, a better credit risk and a far better competitor.

The electrical dealers have many problems to solve which are similar to those of the jeweler. Contract and repair work should be separate from merchandising.

Gross Profits Too Low —

The gross profit on many advertised articles is too low. The combined effort of dealers can rectify this, but the dealer must fortify his argument with

the manufacturers, with figures showing the cost of doing business.

We are now entering a period of readjustment which may result in depressed business conditions for a time. No doubt prices of electric appliances, in sympathy with other lines, will gradually decline until a proper level is reached. Great care should be given to carefully adjust stocks, and cautious buying should be the rule.

The instalment business as applied to many of the larger electrical appliances should be very care-



This display which appeared in the window of Nathan-Dohrmann Company, San Francisco, suggests that the electrical contractor-dealer can gain a great deal from observing the methods which certain large department stores use in selling electrical apparatus.

fully studied and this line of credit avoided by all who are not financially able to carry such accounts. It should also be borne in mind that any general business depression which would result in any considerable amount of unemployment, would reflect seriously on the ability of the dealer to make normal collections on instalment accounts.

There is but one conclusion in summing up the question of the appliance dealer and his future. There can hardly be found a field of action more promising and bright, and the possibilities are almost unlimited. Yet no prophet today can state with any degree of certainty, whether the vast and profitable business of the future in these lines will be done by the electrical dealer or his competitor. The man who meets present day conditions in a wise, up-to-the-minute manner will reap the reward.

MOTION PICTURES IN THE HOME

A New York inventor reports that he has converted the regular roll film to a non-inflammable flat record. On each 10½-picture record there are 1300 pictures equal to 85 feet of roll film. Pictures are converted to the spiral records from the ordinary roll film, yet the reduced pictures retain all the clearness of the original. The picture record is mounted on a machine with a plug for an electric lamp socket.

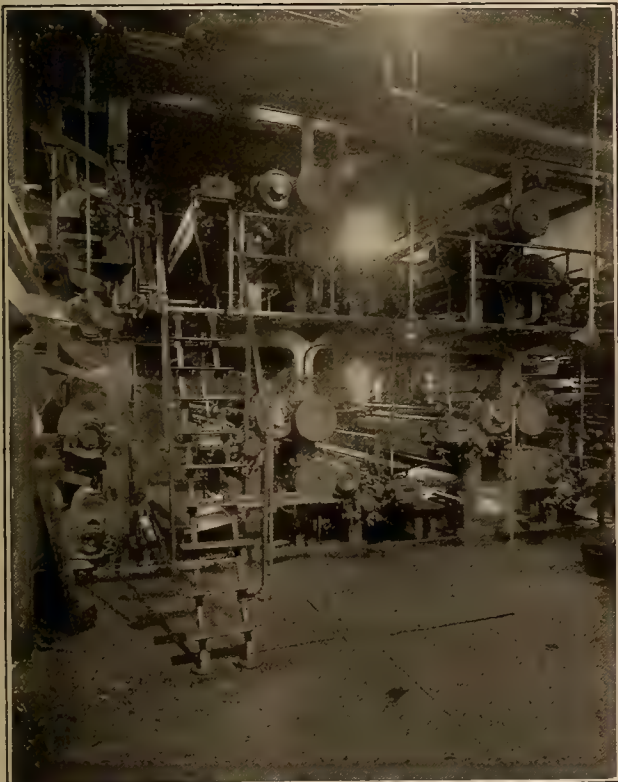
Increasing Production Through Good Lighting



In the large lamp assembly room of a modern lamp factory this scientific diffusion of artificial light from above is even more favorable to close detailed work than daylight from the side windows.



Lighting by angle reflectors and flood lights enables employees in the plant of the Southwestern Shipbuilding Company at San Pedro, California, to work as safely and rapidly by night as by day.



The giant octuple press in a San Francisco newspaper office, with a capacity of 50,000 32-page newspapers per hour, is lighted with 18 75-watt lamps and Benjamin elliptical angle reflectors, horizontal intensity 7-ft. candles.

Along with the discovery that proper lighting and efficient work go together, there has arisen the most widespread interest in the science of industrial lighting. The elimination of glare, and the study of the exact intensities and angles of illumination required for different types of work are doing much to increase production as well as safety.



Lathe work in the machine shops of the National Lamp Works of the General Electric Company, requiring close concentration on details, is facilitated by an average horizontal light intensity of 10 ft.-candles.



A light intensity of about 8 ft.-candles is maintained in this Oakland machine shop, where a lighting installation by the Westinghouse Company gives an evenly distributed illumination without glare or deep shadows.

Industrial Illumination

BY J. J. McLAUGHLIN

(Up to this time the ideal of artificial illumination in the industrial plant has been an approximation to daylight but here an Illumination Engineer with the Westinghouse Lamp Company shows how a scientifically planned overhead lighting system is even better for fine work than the natural light from the windows. The many advantages of this system over the system of local illumination previously used are also shown.—The Editor.)

For some time past the fragile, unsightly and expensive system of drop lighting in industrial plants has been slowly replaced by large, efficient overhead lighting units. The local lights were irregularly placed, hung at various heights, and in a more or less dilapidated, not to say unsafe condition. Com-

overhead lighting for detail work. When the local drop light was inadequate under the old system, a larger wattage lamp has been the simple remedy. "One light only will not make any difference in the operating expense of a whole factory," thought the workman, and besides, a large lamp bulb was the



Scientifically designed general overhead lighting has replaced the local lamps in this department of a lamp factory where the most exacting detail work is performed. The size, height and color of the lights, the focusing of reflectors and spacing of lights, and the spacing of the units over the room have all been planned with care.



A daylight view of the room shown opposite. It can be seen that the artificial illumination is as good as the natural light, and further that the symmetric spacing of the overhead lights makes the former more uniform than that coming from the windows in the far end of the room.

monly they were not designed nor placed by an engineer conversant with maintenance efficiency or hygiene. The general or broadcast lighting installations that are replacing them consist of larger wattage lamps, spaced on symmetrical centers, or placed carefully and sensibly with reference to the locations of machines, tables, benches or aisles where the work is performed. The systematic and symmetrical placing of these machines or tables has contributed to the symmetrical placing of the overhead lighting units, with the final result that the entire space changes from one that gave an impression of an unkempt, haphazard junk shop to one that is free and open, clean and cheerful.

Yet this transformation from local to general lighting progresses very slowly. Work of the ordinary degree of exactness and precision has been illuminated successfully with general overhead lighting, but local lighting is still used for fine or close work under the misapprehension that such operations can be illuminated satisfactorily in no other manner. Case after case establishes the proof that a proper overhead lighting system may satisfactorily replace the local lighting system at a lowered cost.

Errors of Local Illumination —

Other factors just as important as the foot-candles required for a given close operation should be considered in designing and applying general

average workman's idea of good illumination. Often one sees large lamps half again as large as the reflectors, or the reflectors entirely removed to allow larger lamps. Furthermore, if the local light was glaring it affected but one operator; and very little was ever said about it; or if it were wasteful, its correction was neglected because of its apparent insignificance.

But with general overhead lighting the spacing and mounting heights of lamps and reflectors, as well as types of reflectors, lamp sizes and colors must be in accordance with the very best engineering practice, else the entire operations suffer.

Illumination in a Lamp Factory —

In the department of a lamp factory where the work of winding fine wire on lamp arbors is done almost entirely by hand, there must be no variation and no mistakes. Before the new general illumination, as shown in the illustration, was adopted, local lighting units were used which were made up of brackets fastened to the tables, with tin angle reflectors painted white on the inner reflecting surfaces and equipped with 25 to 60-watt clear Mazda B lamps. This fixture was placed very close to the clamp, thereby giving a high intensity varying from 15 to 30 foot-candles, depending upon the size of the lamp used for each working position, and effective over only a limited area closely surrounding each

lamp. There being no overhead lamps, the other parts of the department were very dark, thus creating an impression of gloom upon the workers.

There was a constant and unavoidable strain on the eyes, since they had to be adjusted from the excessive brightness near the hands to the other extreme of darkness in the balance of the room. Such conditions resulted also in poor supervision on the part of the person in charge of the department.

Change to Overhead Lighting —

These disadvantages resulting from local lighting were removed, and improvements in various ways were added by installing the new overhead general lighting. After careful engineering study the Mazda C-2, or "daylight" lamp was used in order to obtain as nearly as possible the same color effect as the natural light, and to secure detail and contrast when observing the fine gray filaments during the mounting operations. A good idea of the close approach of artificial illumination to daylight conditions is obtained by comparing the view of night conditions with the one showing natural lighting at midday. In fact, the distribution of artificial light is more uniform than is daylight illumination. This is due to the fact that the lamps, spaced symmetrically overhead and across the room, give the same intensity of illumination upon each square foot of floor area, whereas the natural lighting, coming from the windows on the sides, decreases rapidly from the windows to the center bays.

On clear days the intensity of natural lighting being high in the bays adjoining the windows, the artificial lighting is not required at these points. But due to the rapid decrease of daylight intensities towards the center of the room, the artificial lights are here used during the entire day and no marked contrasts are noticeable between lighting values nor in work accomplished. On cloudy days and late in the afternoon it is necessary to use all of the lamps. Thus through the flexible switching and the Mazda C-2 daylight lamp, the blending of intensities and colors is successfully accomplished. No such results had ever been possible when using individually controlled lights.

In the accompanying illustration a filament of a 40-watt Mazda B lamp is shown mounted on a stem. This view was taken at night under the new lighting system and it is evident from the unretouched picture how well a fine wire can be seen.



A picture taken at night under the new lighting system which shows how the finest lamp filaments can be seen perfectly.

always be made before general illumination from overhead units can be applied successfully. General

that helps very materially to make the filament stand out is the black cloth receptacle, seen just below the clamp. This forms a background for viewing the filament when it is mounted on the stem.

A careful study of the actual requirements of lighting close work in an industrial plant must

lighting is usually preferable to local lighting for even the detail manufacturing operations, but it is not "fool proof." The improvement described above is due not merely to a change in the system, but results from proper lamps at the right height; proper focusing reflectors to eliminate waste light; proper color of light, and proper control.

Necessity of Careful Analysis —

If a general overhead lighting system is to do more than a local lighting system can accomplish, the following factors must be considered: The amount and direction of the natural lighting coming through the windows; the requisite intensity of illumination in foot-candles; the vertical, horizontal or angular surfaces and the color of the work to be lighted; the type of reflector, chosen for its illuminating characteristics, its durability and its ease of maintenance; the lamp itself, as to color of light, fragility and glare; the spacing of lamps and reflectors with reference to the work; the height of the lighting units; the background against which the work appears; the flexibility of control, and the elimination of polished surfaces directly within the field of vision of the work.

CHRISTMAS OVER THERE

No situation is serious enough to overshadow the importance of Christmas in the American mind. One would suppose that a Christmas tree for the army of occupation in Germany last year was an



A Christmas tree for the army of occupation which appears erected in the center of a small German town was a thing of beauty as well as of cheer. We do not always do as well here at home with all facilities for illumination at our service.

impossibility, but in spite of war, ruin and cold, a glorious tree glowed in the center of a German town on Christmas eve and sent out its cheer to the conquered people and homesick soldiers.

\$225,000,000 in crops were raised in Washington in 1919. The Columbia basin project will almost double the arable acreage of the state.

HELP WASHINGTON
PUT IT OVER

The Desire Store

BY H. B. ROGERS

(A certain Washington dealer has dared to rival the neighboring jeweler in beauty of shop arrangement and display of his wares. This fascinating description of the entire store from lamp counter to fixture room is told by the local manager of the Spokane Pacific States Electric Company, who firmly believes that the electrical store should hold a place as the most charming and commandingly beautiful of all retail stores.—The Editor.)

Believing that the electrical store should not be simply a place to purchase things electrical but that it should create a definite desire for certain articles in the customer's mind,

a certain electrical dealer of Wenatchee, Washington, has opened a shop which might well be called the 'Desire Store' because it caters to the individual's natural desire for beautiful as well as useful electrical goods in the home and because through artistic arrangement it definitely creates a desire for certain articles in the mind of every passer-by.

The electrical appliances in this Electrical Supply Company store are so placed that the application of each is shown in a practical demonstration of just how one should use electrical service to make it a willing and silent servant.

Furniture, fixtures and hangings have been planned so as to make a contrast especially pleasing to the eye. Each appliance is connected from a convenient outlet and placed in the correct position in the store, just as it should be placed in the home.

Treatment of Display Windows —

The trim of the broad display windows is changed every other day, one appliance and one only being shown at a time. For instance, on a particular day vacuum cleaners only are shown.

A policy which Frank Smallidge, head of the company, claims as one of his largest assets, is that of selling only one make of each article. Merchandise that is backed by national advertising and reputable manufacturers is chosen and then, by consistently hammering away on this one make, the merchandise is made an integral part of the store.

Arrangement of the Interior —

When entering this store one is not bewildered by a mass of merchandise or fixtures hanging from the walls and ceilings, but is pleased with the beauty of arrangement in every section. If a bracket is shown it harmonizes with the surroundings and is so placed, not as much to display the bracket as to demonstrate the fact that a bracket is needed there.

The store is lighted, not with fixtures suitable for a bedroom, but with fixtures chosen for this

store and for this one only; they are not samples, but permanent designs chosen for illumination and are noticeable for their simplicity and beauty.



Each appliance in the shop of the Electrical Supply Company of Wenatchee, Washington, is connected with a convenience outlet and placed as though it were in the home. The French doors lead to the fixture rooms and the roomy mezzanine is used for displaying shades and for the business offices.

French doors with cretonne hangings lead to the fixture rooms. Entering these one does not see a mass of metals but rather a few very well selected designs, finished to harmonize with everything in the room. Realizing that all do not agree on color schemes, the designers of the shop have provided two of these rooms, so decidedly contrasting as to color that the customer can match fixtures in either a dark or light room.

The men of this shop have learned that the customer does not buy fixtures but that they must be sold. Their pre-

dominating fixture room idea is, that the little niceties make the larger sales.

The Kitchen Display Room —

This store has a complete electric kitchen, with range, water heater, dish washer and food grinder, permanently arranged for the ideal kitchen. There is also a 52-gallon tank, lagged, always hot, and a range always ready for service. Cooking demonstrations held here result in a steady sale of electric ranges. So closely is the 'one make' policy followed that the store will not order other makes. "We give service on these goods," they state. "We believe through them we can give better service to our trade and make more money for ourselves."

A roomy mezzanine runs on two sides of the store and the office is located at the rear of the same. This mezzanine is used for displaying shades and has the appearance of a balcony running over the fixture rooms.

The Lamp Counter —

The lamp counter is at the rear of the store and all lamps are kept in cases, where they are out of sight, except when being shown. Each purchaser of lamps must walk the complete length of the store before arriving at the lamp counter and in so doing he must pass all displays. Naturally there is some one thing in which that person is interested. Thus this well nicknamed 'Desire Store' plays upon the half-formed desire already in the customer's mind.

Novelties in Lighting

BY M. LUCKIESH

(The rise of the electrical home idea has given an extra impetus to novel and artistic lighting effects in the home. The dealer, the contractor and the home-builder will find interesting ideas in the following suggestions by the director of applied science at the Nela Research Laboratory.—The Editor.)

Although lighting-fixtures, in the ordinary sense of the term, can be purchased or made to meet the requirements of lighting in the home, the possibilities of novel effects are as various as the details of houses, and the taste and means of householders. For this reason it would be an endless task to cover this subject fully. However, it should be of value

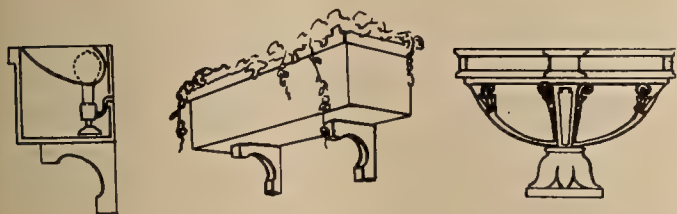


Fig. 1.

Fig. 2

The dining room or enclosed porch is given a certain out-of-doors charm by the imitation window boxes shown to the left and the odd corner is transformed when lighted by an urn such as the one shown above.

to read of a number of expedients which have been utilized with success. Some of these are very practicable, and should find much wider use in homes; others are of such a special nature that the descriptions may be useful chiefly in suggesting solutions of different problems. Even in the small house there is room for novelties, but in the larger houses an ingenious architect can weave into the structure various novel effects which will be a source of constant interest and pleasure. Naturally, color plays a conspicuous part in lighting novelties.

There is a long span between the common fixtures, such as ceiling fixtures, wall brackets, and portable lamps, and the constructed places for concealing lamps such as cornices of rooms and capitals of pilasters and columns. The latter are no longer novelties in lighting, many applications of this type of 'concealed' lighting having been made in large interiors. However, little has been done in the home in this direction, so that even cove-lighting may be considered novel. But between these two extremes there are many possibilities.

Wall Boxes

Such a room as the sun room, or even a dining room of appropriate type, may receive its secondary general illumination of moderate intensity from wall-boxes. These may be imitation flower-boxes from which artificial foliage protrudes. The lamps may be concealed in a box such as that illustrated in Fig. 1, and reflectors may be used for distributing the light evenly upon the ceiling. However, if it is desired to have a box of the smallest possible dimensions, the reflectors may be dispensed with, and the interior of the box provided with a white coating. White paint containing oil or varnish is undesirable for this purpose, for when in close proximity to operating lamps it scorches and becomes brown. A

'water' white coating serves well for this purpose and there are many products of this character available which are improvements upon the old-fashioned 'white-wash.' In such a wall-box, tinted or deeply colored lamps may be concealed, and colored effects may be readily obtained. Such boxes are easily installed in houses already built by providing wall-receptacles. Switches may be placed on the boxes, and the connections made to the wall-receptacles by means of ordinary connecting plugs.

An urn such as that illustrated in Fig. 2, or a large vase, can be bored near the base for inserting



Fig. 3

Fig. 4

Fig. 5

The portable urn-pedestals shown in Figure 3 afford excellent places from which to obtain generally diffused light. The piano or bookcase corner is greatly improved by the illumination device shown in Figure 4, while a modification of the wall-box is shown in Figure 5.

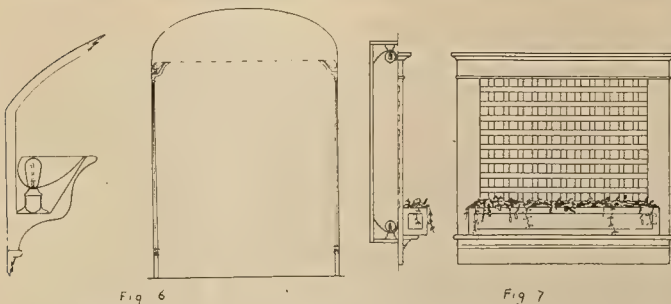
the necessary wires and a lamp and reflector can be installed very easily. If the converted device is placed upon a pedestal or article of furniture so that its upper aperture is about six feet from the floor, very satisfactory indirect-lighting is obtained. Combination urns and pedestals such as illustrated in Fig. 3 are convenient portables. For the home a single reflector and lamp will usually be sufficient but for large rooms the urn may be large enough for several reflectors. These devices afford excellent places from which to obtain generally diffused tinted light and even striking color effects for special occasions. Several small fixtures of this character may be used in a large room.

There are many kinds of portable objects in which a reflector and lamp may be concealed. In Fig. 4 is illustrated a small ornamental object devised to conceal a lamp and to set upon the piano, mantel, or bookcase. A modification of the wall-box or of the smaller ornament just described is illustrated in Fig. 5 by means of internal and external

35,000 new homes are required to meet the needs of Oregon's increased population. If twenty outlets were placed in each of these homes, this would mean a business to electrical contractors of that state of \$3,500,000.

HELP THE NORTHWEST ELECTRIC SERVICE LEAGUE PUT IT OVER

views. This device contains a reflector and therefore is fairly large although it can be made to project only three inches from the wall. If it is built as a part of the architectural design there is no reason why a cavity in the wall may not be provided to minimize its projection. These can be used in various



The unavoidable dark and gloomy corner can be converted into a charming spot through the artificial skylight arrangement shown to the left and the undesirable view can be replaced by a glowing window as shown in Figure 7.

places such as vestibules and hallways for primary lighting. They can be employed in the sunroom and dining room as secondary lighting effects.

Projections for concealing lamps for the system known as cove-lighting must be a part of the architectural or decorative scheme. In large interiors such projections may be large enough to provide space for reflectors but in the smaller room, ingenuity must be exercised to make such a device of small projection. Reflectors may be dispensed with and a cavity provided in the wall. This may be backed with metal lath and plaster and the clean surface of the plaster may be utilized as a reflecting surface. A cove for concealed lighting is shown in Fig. 6.

Artificial Skylights

Artificial windows and skylights have their applications in the home, and a number of these have been installed. It is easy to make such a window if there happens to be a window which is useless or undesirable for admitting daylight. The window-sash may be removed and placed on the extreme exterior of the frame where the storm-sash is ordinarily installed. This may be covered on the inside by means of cardboard, composition-board, asbestos-board, or any other suitable material. At the extreme interior of the frame a lattice or decorative glazed sash may be installed. If the former is used, an artificial vine climbing upward from a flower-box may be entwined in the lattice. Lamps may be installed as shown in Fig. 7 and a charming effect is obtainable. If bluegreen lamps are used, moonlight is simulated with satisfactory results. The desired color may be obtained by tinting the lamps, by using colored glass over the reflectors, or by tinting the background which covers the inner side of the exterior sash. If satisfactory results are to be achieved by coloring the background, the latter must be confined to it. A uniform brightness of the background may be obtained by shading it by means of a brush and suitable gray coloring.

A small alcove or vestibule isolated from daylight may be provided with an artificial skylight, or such an expedient may be resorted to deliberately

in preference to ordinary fixtures. A cove may be built about two feet from the ceiling depending upon the height available, and the ceiling may be curved as shown in Fig. 6. A sub-daylight of glazed sash or merely of lattice may be installed as indicated by the dotted line in the diagram. In a vestibule where the height will not permit of a suspended fixture owing to interference from a door when it is opened, a small skylight may be installed flush or close to the ceiling. Behind this a white box or reflector can be provided with suitable lamps. Such devices may be placed in the ceiling above a window-seat or in any appropriate nook.

In one large residence a large oval of diffused glass made of leaded panels was set in the ceiling of a dining room. Above this panel a large number of lamps were installed in a recess specially provided for the purpose. In this particular case, red, green, and blue lamps are used in three circuits respectively. These were controlled by means of separate rheostats set in the wall at a convenient place. By varying the intensities of the three circuits, various tints can be obtained.

Light for Emphasis

A miniature of a folding screen may be mounted upon a pedestal to surround a light-source on three sides, the open side being the one nearest the wall. Such a fixture will vary from about three to four feet and can be used to illuminate a painting or other important object. It has the advantage of doing this apparently casually, whereas the chief objection to fixtures specially mounted for illuminating a painting is that their purpose is often so obvious as to be obtrusive. A similar lighting effect may be obtained by means of a lantern on a pedestal, the lantern having a panel with clear or slightly diffusing glass, or even without glass. Such fixtures provide a novel distribution of lighting somewhat simulating that of daylight from windows.

The foregoing idea may be modified by providing for better control of the light, even to the extent of using small reflectors or spot-lights. If such devices can be concealed they may be used to 'spot-light' important or interesting objects. A mirror may be placed in a proper position on a suspended bowl or at the top of a portable lamp, so that a beam of light is reflected to a picture or other object. Several mirrors may be used on the same fixture for illuminating several objects.

Useful Practical Devices

There are many special devices applicable to the home which have a utilitarian purpose. The chief difficulty encountered is to find these devices upon the market. Many of them have been made and installed according to specifications in the particular case, or by individuals who saw their advantages and took the trouble to have them made. A description of a few of these may suggest solutions to other specific problems.

A small lamp installed in the proper place in the modern phonograph for illuminating the needle while it is being adjusted is a convenience which after

using becomes a necessity. There are several easy methods of installing it. A small lamp of standard voltage and candelabra base may be installed in a reflector with a convenient switch for controlling it. In fact, the switch may be controlled by the closing and opening of the lid of the instrument. The bell-ringing transformer is now available at a very low cost. This may be concealed in the case of the instrument and connected with a miniature lamp fastened to the mechanism and illuminating the needle. In fact, the lamps and reflectors used on the instrument-boards of automobiles can be adapted very easily to this purpose.

As a matter of safety, lighting devices are used to illuminate steps which are ordinarily dangerous. Usually a small fixture containing a lamp is embedded in the structure, flush with the surface. Such a device set in the door-casing outside the entrances of the house, at a height of about four or five feet, is a safeguard for the housewife. By controlling it on the inside, she can clearly distinguish the face of the caller when desired. These would be useful only when a fixture is not available, or cannot be installed in the proper location.

Everyone has experienced the annoyance of searching for a house-number at night. How much satisfaction it would be to have house-numbers illuminated. To operate the lantern at the entrance for several hours every evening is unduly costly, and in most cases would not adequately illuminate the number. It is easy to devise a small metal box containing one or two miniature lamps connected to the bell-ringing transformer. The number can be painted upon a diffusing glass and protected by a clear glass which forms the cover of the box. If the lamps are operated below their normal voltage the amount of electricity they will consume is almost negligible. Furthermore, the lamps will operate for years before burning out. If desired, a time-switch can be provided for controlling this device.

Those who become interested in lighting will be surprised to learn how many switches, sockets, and other lighting accessories are available to be adapted to the needs which arise. Simple flashers for producing lighting effects automatically can be obtained. Sockets in which a dimming device is incorporated are available for night-lights in the bathroom, hall, or sick-room. If it is desired to 'turn down' a pair of candlesticks or two other lamps, a switch can be obtained which will place them in 'series' and will also make it possible to burn them at their normal brightness in 'parallel' when desired. 'Pilot-lights' are convenient to show when an electric flat-iron or other electrically heated device is in operation. Such conveniences are appearing on the market. Although lighting is inexpensive because of the few hours during which it is in use each day, a lamp which burns for a week in the attic will add materially to the lighting bill. For example, a 25-watt lamp operating for a week will cost the householder from 20 to 40 cents, depending on the rates. Indicating switches or pilot-lights in convenient places might be worth while as indicators of lamps and other devices burning unnoticed.

WIRELESS APPARATUS FOR THE ELECTRICAL DEALER

BY LOUIS ETSHOKIN

(Wireless telegraphy is rapidly becoming our national indoor sport, and for this reason the progressive electrical dealer will make his shop a wireless supply center. The wireless boy can bring a remarkable number of general electrical sales to the dealer he knows and likes. And for this reason as well as for the pure merchandising profit which can be made, the dealer will find it well worth while to handle wireless apparatus.—The Editor.)

Wireless telegraphy was stimulated by the war, more than any other one phase of electrical development. Not only was a remarkable advance made in the science itself, but interest on the part of the general public was greatly increased. Prior to 1914 most people knew of Marconi and were familiar with the meaning of S. O. S. Nevertheless the public in general was not vitally interested in the subject of radio and very few electrical schools gave wireless courses.

Then with the war wireless telegraphy began to attract attention. The public learned that there had been regular trans-oceanic wireless communication by German stations as well as by Marconi ones. Wireless was among the important "winning the war" factors and for this reason was a subject of national interest.

Just previous to this time, great improvement had been made in wireless reception so that long distance messages could be received with a small aerial. This made many private wireless stations possible and in a short time there arose a great body of young radio disciples or "fans," as they were called. When, with the war, the demand for operators grew from the hundreds into the tens of thousands, the amateurs formed the backbone of the army and navy and radio signal corps. But even these were not enough to supply the demand. The rest had to be trained. The Naval Radio School at Harvard, alone, had nearly five thousand men.

Present Radio Interest —

Now with the close of the war, we find a tremendous supply of trained wireless operators in every section of the country. Most of these men do not want to get out of the wireless game. They have found it too fascinating to drop, and furthermore, their younger brothers are rapidly acquiring the wireless fever. There used to be a few wireless enthusiasts. Now there are few boys who are not wireless enthusiasts.

The electrical dealer can test this out by asking the boys who come into his store if they are interested in wireless. The result will most likely be surprising. A look around any neighborhood for wire-

909,508,000 people live in the countries bordering the Pacific Ocean. The supplying of a great part of their needs belongs to the western seaboard of North America.

HELP THE PACIFIC COAST
PUT IT OVER

less antennæ confirms the statement that wireless is America's indoor sport as baseball is her outdoor sport. Both are in keeping with the keenness and intelligence of American boys.

There is, therefore, an ever increasing field for the electrical dealer in handling wireless supplies. He is the logical salesman, since wireless can properly be classed as an electrical application.

The Wireless Boy's Influence —

Furthermore, the electrical man who handles wireless apparatus will gain the friendship of most of the boys in the community. And these have the power to determine a great many general electrical sales. When an electric percolator or vacuum cleaner is contemplated by some member of the family, is

not Johnny, the electrical expert, referred to as official advisor? A chap who hears to Honolulu every day is generally considered an authority on electrical appliances.

And so the wireless youngster's respect is well worth having. He is the electrical point of contact between the home and the dealer. In a few years he will be having his home wired and will be buying appliances for himself. The wise electrical dealer will get him used to coming into his store.

Then there is a good profit in wireless apparatus from a purely merchandising point of view. It is not bulky. A small show case will hold a fairly complete stock. It always is a good looking display, and featured in a window it is a good advertisement, since it stamps the dealer as a progressive man.

Electric Heating

BY T. D. MacMULLEN

(The problems of electric heating have been the subject of much discussion in the electrical industry, both from the power company's standpoint and from the standpoint of the dealer in electrical heating devices. The following discussion of some of the principles involved is by the secretary and sales manager of the Majestic Electric Development Company.—The Editor.)

There are two methods of heating electrically, and because of the disadvantages of the older method the newer one seems to be the subject of some prejudices in some quarters. When heat is figured on a wattage basis and the engineering formula, including cubic dimensions, degree of temperature obtained, and amount of current consumed, the cost of heating runs high, unless the rate be a very low one. When current is merely consumed and the heat given off into the air, electrical heating is no more efficient than coal, gas, or steam. Heat is developed in some heating devices, and the warmed air surrounding the device rises to the upper part of the room, and, gradually working downward, expels or warms the cold air, and eventually the lower space is heated. The degree to which it is heated depends, of course, on the size of the room, the wattage used and the initial temperature. There are also several secondary matters, such as the composition of the walls, the height of the ceiling as related to the other dimensions, the amount and character of ventilation, the exposure of the room (that is, whether the room faces the weather, whether it is located at the top or bottom of the building, whether it is an inside or outside room, etc.), the number of occupants of the room, and many other factors.

The usual method of figuring has been a very rough one necessarily, but it has been assumed that two watts per cubic foot per degree rise in temperature would warm a room in ordinary conditions to a comfortable degree. It can readily be seen that this is not a satisfactory way of figuring, but it applies in a general way and estimates of heat requirements are vague at the best, because of all the conditions that have to be considered, as outlined above.

Heating By Reflectors

About six years ago the development of electric heat on the principle of reflection was introduced. It increases the efficiency of the fuel-consumption to

an enormous extent, and permits the throwing of heat rays to any part of the room without the necessity for first, or ever, heating the upper part, and without the necessity for making any allowance for ventilation or the other usual conditions that have to be overcome. When light is placed in front of a reflector the rays can be thrown many miles. When heat is used in a similar manner the amount of current ordinarily used in a room—600 watts—can be made to warm an entire section of a room where people may be grouped, and in a few minutes it will warm the whole room. The effect of this method of heating is not to warm the air so much as it is to warm the objects against which the heat is reflected, whether people in the room, or the walls or floor. The sun does not warm us indirectly by warming the air. It warms us with its direct beams, and if the direct beams are shut off we are cool. The sun also warms the earth, of course, and by radiation or reflection from the earth the air is warmed and everything upon its face. If we insist on figuring electric heat efficiency under the formula mentioned heretofore, we will get from 600 watts the amount of heat we get from a flat iron, and it would take just as long to warm a room as it now takes a flat iron to warm a room. Under the later method of portable reflector type of heaters, we get immediate heat wherever we want it, and an ordinary sized room is warmed in a few minutes. This same type of heat is arranged for in larger wall heaters resembling fireplaces, made in several sizes and in wattages ranging from 1200 to 3000. A 1500 to 2000-watt heater will warm a large room in a few minutes. A 3000-watt heater will warm a large hall in the coldest climate.

Economies and Comforts of Electric Heating

Electric heat, as compared with any other type of heat, stands out as favorably as the electric light compared with the oil lamp. With most of us the

thought of warming our house instantly suggests labor and dirt, and a heavy atmosphere. The oil stove entails the messy filling of a heater from a dirty oil can, with oil on the floor and furniture and a heavy smell pervading the house for long afterwards, and the lighting of the stove is but a continuance in another form of these objections. If a window is opened a little of the odor passes out, but so does all of the heat.

Coal and wood fires are pleasant to look at, and ever desirable, regardless of objections; but of the great mass of people, how many do not look at a fire in a grate and reflect that some one has had to haul in wood and coal, and that some one will have to clean out ashes and scrub the mantel and dust the furniture the next day? And there is always the uncertainty of the coal supply, as for instance during last winter.

Steam, or hot water heating, is out of the reach of most people, but when it is used it is either developed from an uncertain oil or coal supply, or it is brought from the basement furnace, and there is the coal situation all over again, and the necessity for night and day attention. Heat from these radiators has to be provided for hours sometimes before it is wanted, and who, on coming in late in the evening, would not prefer going to bed without heat to going into the cellar to stoke a furnace and then wait for the heat to come?

And with all of these types of heat there is waste on every side, in the stove or furnace, up the flue and in the room, and through ventilators. Reflected electric heat takes but a turn of the switch and it is there instantly.

Gas and Electricity

At the recent Pasadena Convention there was considerable discussion of electrically heated furnaces for industrial purposes, and some emphasis was laid on the revenue the power companies were deriving from this source. The writer took occasion to bring up domestic heating in this connection. The revenue to the power companies is not always a consideration, as during the power shortages additional loads are not attractive. Also, it is too often the case that the power-and-gas company is too anxious to retain its rapidly diminishing gas business in the realm of heating and exploits the gas to the detriment of electricity. I think a point should be made of this, and something of a campaign undertaken to bring the gas-and-electric companies to a point where they will consider their electric business on its own merits, and if it is the will of the public and the destiny of the gas business that the gas business be eliminated, the power company should not make the electric business dance to its tune. Too often, even where heating rates are established by regulatory bodies, the power companies find ways of refusing such rates to the public by claiming no facilities, etc. This, of course, applies to the companies who are urging their gas business in preference to electric, and I think a suggestion that heating rates be made more attractive and that the companies reverse their attitude and seek heating business, would mean that

in a few years this great problem of national importance would be solved.

The country is lighted by electricity, the factories are run by electricity, railroad lines and now ships are using it, and with heating and cooking accomplished electrically we shall have an electrical nation. It is sure to come and no one in the industry should obstruct it, but rather publicly and privately hasten it.

Western Ideas

YOUR NEW HOME is your best publicity feature. An effective sign over the door's even weeks before they open will acquaint the public with your new situation and arouse curiosity as to the appearance of the new shop.



The Western Gas and Electric Appliance Company of California took advantage of moving time by advertising their new home well in advance.

MERRY CHRISTMAS is the one time you have a chance to play with the company's kiddies. Any employe will appreciate a good time for the kiddies more than any other courtesy the company could extend.



This is a picture of the 1919 Christmas party given to the younger members of the British Columbia Electric Railway Company, Vancouver, B. C.

\$597,149,796 in foreign commerce passed through the Port of Seattle in 1918. Seattle, through her remarkable port facilities, is helping to build up West Coast trade with the Orient.

HELP SEATTLE
PUT IT OVER

Pamphlets and Clippings in a Business Library

BY VIRGINIA FAIRFAX

(What do you want to know? Business and scientific information that it would take you years to discover for yourself can be had for the asking if you know where and how to ask. In the second of a series of articles the librarian of the Carnation Milk Products Company, Chicago, discusses governmental and other publications for commercial and technical men. Permission to reprint from this series must be obtained in writing from the Journal of Electricity.—The Editor.)

THE SOURCES AND SELECTION OF MATERIAL — PART I.

Every progressive business organization aims not only to avoid hasty judgments but also to expand and develop its business on a permanent basis, explore new commercial avenues and detect the course of competition. In order to accomplish this end, a systematic collection of accurate business facts must be made and intelligently used.

Periodicals and National Commercial Organizations

Every business man should keep himself informed and up to date on matters that pertain to his special business interests by reading his local newspapers, possibly one or more out of town financial and commercial papers, and by reading the periodicals of his specific trade, business, or profession. The engineer, be he civil, electrical or mechanical, receives the various periodicals that pertain to his special calling; the lumber man, the oil man, the coal man, the export man, the banker, each have their special journals as do all other lines of business.

In addition to the newspapers, financial, trade and technical periodicals, the clipping and filing of which will be discussed in a later article, each of these special classes of business men receives from the technical, trade or commercial organizations to which they belong, bulletins, monographs and reprints written by authorities, and containing the last word on processes, surveys, investigations, laws, results reached in the thousand activities of the world's work, and without which sources of information the workers of today could not keep sufficiently informed.

For example, the electrical engineer in business reads, or his librarian reads for him, some, if not all, of the following periodicals: the Electrical World, the Journal of Electricity, the Electric Journal, the General Electric Review, the Electric Railway Journal, and the journal of his technical society, the American Institute of Electrical Engineers. From the national commercial association of his industry, the National Electric Light Association, he receives a monthly bulletin containing up-to-date facts and figures on the electrical industry. He may also avail himself of the small periodical entitled "Rate Research," published weekly by the National Electric Light Association, which gives all the latest commission decisions with extracts from articles on subjects which bear upon electrical rates. The National Electric Light Association also issues for his benefit the "N. E. L. A. Rate Book," with three quarterly supplements, which gives him electric light and power

rates in force in all cities of 25,000 population or over. He also receives in pamphlet form from this association the important papers and reports of committees which are presented at the annual meetings of the Association and which later appear in bound volumes. All other special classes of business men are aided in their special industries by their periodicals and commercial associations just as the electrical man is aided in his particular industry.

A fairly complete list of "Commercial and Industrial Organizations of the United States" with data about each organization, including the address of the secretary, revised to November 1, 1919, has been issued by the Bureau of Foreign and Domestic Commerce (Miscellaneous Series No. 99). It may be purchased from the Superintendent of Documents, Washington, D. C., for 15 cents, or may be obtained from the local office of the Bureau of Foreign and Domestic Commerce, established in some of the larger cities of the United States.

References to some of the most valuable material to be obtained for the information files is scattered here and there in the text of periodicals. Lists of pamphlets under such headings as "New Trade Publications" and lists of advertisers and classified lists found among the advertising pages should not be neglected as possible sources of value. It is essential in a business house that the information files be administered by a trained librarian who knows how and where to look for material of interest, and who watches for announcements of new publications when reading periodicals and newspapers in search of business facts.

Pamphlets Issued by Banks

Many of the banks of the United States issue regularly very valuable bulletins containing trade and financial information, and are most generous in sending their publications gratis to business houses requesting them. Some of these banks are the following:

- The National City Bank of New York
- The National Bank of Commerce in New York
- The Irving National Bank, New York
- The Guaranty Trust Company of New York
- The National Shawmut Bank of Boston
- The National Bank of San Francisco

Most of these banks print a list of their publications which they will send to business houses from which a selection may be made. Other banks, such as the Continental and Commercial Banks, Chicago, print their publications only occasionally and these will be noted in reading the newspapers and periodicals.

Chambers of Commerce at Home and Abroad

The Chambers of Commerce in various cities of the United States, organized to promote commerce and advertise their communities, are excellent sources of information. Foremost among these is the Chamber of Commerce of the United States at Washington, D. C., which has an exceptionally fine information bureau.

Any business organization interested in foreign trade will find valuable sources of information in the American Chambers of Commerce established in foreign countries, a list of which with addresses can be had from the Bureau of Foreign and Domestic Commerce, Washington, D. C., or from the branch offices of that bureau in various cities of the United States. These Chambers of Commerce will furnish data pertaining to their foreign localities.

There are also foreign Chambers of Commerce or Associations with offices in the United States, such as, The Argentine-American Chamber of Commerce, the Chinese Chamber of Commerce, the American-Asiatic Association, the French Chamber of Commerce, and many others, which are prepared to furnish trade information of their respective countries. A list of the foreign Chambers of Commerce established in this country may be obtained, with their addresses, from the Bureau of Foreign and Domestic Commerce.

The International Chamber of Commerce, formed in Paris in June, 1920, plans a complete and reliable information and statistical bureau for international trade available for all interests and countries.

Pamphlets From the United States Government

The departments of the United States Government operating through their various specialized bureaus publish in pamphlet form or mimeograph sheets, information that every business man should obtain and use. To become familiar with this large amount of pamphlet material which has been issued and is constantly being issued is not an easy task, and to select the pamphlets applying to a particular business, requires a large knowledge of Government resources, which the trained librarian can supply to the business house.

The best method of keeping posted on what the Government is publishing is to obtain the printed catalogs of publications that have been issued by the various departments and bureaus, and supplement these by subscribing to the "Monthly Catalog of Government Documents" obtainable from the Superintendent of Documents, Washington, D. C., price 50 cents per year, which records all pamphlets issued each month by all departments and commissions of the Federal Government.

The following is a select list of the printed catalogs of the pamphlet material issued by the various departments and bureaus of the Government which are especially useful in business, and which will guide in selecting pamphlets and tell which ones are free for the asking and which ones must be paid for.

U. S. Department of Commerce

This department issues a yearly list of publications with a monthly list of additions. It maintains a mailing list of people who ask to have this catalog and the monthly additions sent to them. This list of the Department of Commerce contains the publications of its bureaus, three of which are of special interest to business, namely, the Bureau of the Census, the Bureau of Foreign and Domestic Commerce and the Bureau of Standards. Each of these bureaus issues a separate list of its own publications which may be procured from the bureau if desired. The catalogs of the Bureau of Standards and the Bureau of the Census give very full annotated descriptions of the contents of their pamphlets, which are not given in the list issued by the Department of Commerce. They also record publications out of print, but that may be seen at the Public Library, and aim to be a complete catalog of everything that has ever been issued by that particular bureau. They do not, however, issue current lists of new publications, so that the monthly supplements issued by the Department of Commerce covering their publications is of value. The "Monthly Catalog of Government Documents" also covers their current publications.

Emphasis should be placed upon the value to business men of the publications of the Bureau of Foreign and Domestic Commerce and the Bureau of the Census. The Bureau of Foreign and Domestic Commerce is an indispensable source of information for firms engaged in foreign trade, and it is also prepared to give data of value to those engaged only in domestic commerce. It issues "Daily Commerce Reports," a valuable pamphlet that contains important financial, commercial and industrial news and statistics gathered from all parts of the world by the American Consular officers and Commercial Agents of the Government. Its price is \$2.50 per year from the Superintendent of Documents. This bureau not only furnishes printed pamphlets but also issues advance trade information on mimeographed sheets. From it also may be had lists of importers in foreign countries of various American products and manufacture.

The Bureau of the Census furnishes for business use, statistics not only of population but also of manufactures and special industries, and agriculture in general. Statistics of cotton production and consumption are issued frequently during each ginning season, and statistics of tobacco production are issued quarterly. It compiles, every five years, reports on electric railways, electric light and power stations, telephones and telegraph business. An ex-

\$25,000,000 more agricultural products than mining products were produced in Montana in 1918. The great wealth of the state in its farm lands is being made available through its irrigation plans, including electrical pumping.

HELP MONTANA
PUT IT OVER

amination of its catalog of publications will show many other important statistics which the business man may use with great profit.

U. S. Geological Survey

This department issues a yearly list of publications with a monthly list of additions, sent free on request. Among its wide range of pamphlets of interest to business men should be noted particularly its statistics on mineral production and petroleum and natural gas resources of the United States. The petroleum statistics are issued each month on mimeographed sheets, and the Survey also issues monthly statistics on "Production of Electric Power and Consumption of Fuel by Public Utility Power Plants in the United States." This department of the government is also strong in information dealing with water power resources.

U. S. Bureau of Labor

This bureau issues a catalog of publications semi-annually but does not issue any monthly list of additions. These will be found, however, in the "Monthly Catalog of Government Documents" which has previously been mentioned, and also in its excellent monthly periodical entitled "Monthly Labor Review," price \$1.50 per year from the Superintendent of Documents. This Review, in addition to articles and statistics on industrial conditions in different parts of the world, contains, as an appendix, a list of references to pamphlets and books on labor questions published in the United States and foreign countries. The pamphlets and reports issued by this bureau cover conditions of labor in industry, such as hours, wages, employers' liability, also cost of living, wholesale prices of commodities, labor laws, etc.

U. S. Bureau of Mines

This bureau issues quarterly a new edition of its catalog, each issue bringing the complete list up to date. It also issues a monthly list of publications on a postal card which is sent free on request. Pamphlets issued by this bureau cover not only what is implied in the name of the bureau but they also cover the utilization of all mineral resources, such as coal, fuel oil, natural gas, etc. They are valuable to every business man who is concerned with the problems of burning coal and fuel oil, using or selling natural gas, or engaging in the petroleum industry.

U. S. Department of Agriculture

This department does not issue a complete list of its publications but it does issue a monthly list of publications covering the pamphlets issued by all its bureaus. But there may be had from the Superintendent of Documents, free of charge, some "Price Lists" on special subjects which have been treated in pamphlets issued by the various bureaus of the Department of Agriculture. These Price Lists are really lists of bulletins arranged by subject and giving the price of each. For example, there are Price Lists on Farm Management, Weather, Foods and Cooking, Forestry, Animal Industry, Soils and Fertilizers, etc. The publications of the bureaus of the Department of Agriculture are useful to farmers, packing plants, dairy industries, lumber men, dealers

in seeds and many other special lines of business. The statistics and other pamphlets issued by the Bureau of Markets of the Department of Agriculture are also very useful.

Last August (1920) there was created by the Department of Agriculture a new office in the Bureau of Chemistry, called the Office of Development Work. The staff of the new service is made up of engineers who will translate the valuable discoveries of the chemists concerning the utilization of manufacturing waste, or a new dye, or glue, or preservative, etc., into terms that can be understood by the manufacturer and investor.

It is not possible in the space allotted to this article to discuss further the value of government pamphlets to business men, but enough has been said to emphasize the fact that pamphlets issued by the government are invaluable sources of business information.

Should any business man desire to acquaint himself fully with the duties of the various departments of the government and the scope of their publications, reference should be made to "Swanton's Guide to United States Publications," which has been issued as Bulletin No. 2, 1918, of the Bureau of Education, and may be bought from the Superintendent of Documents for 20 cents. The Superintendent of Documents also issues free of charge besides those mentioned in connection with the Department of Agriculture, a large number of "Price Lists" on various subjects that have been treated in the pamphlets issued by the different departments of the government. For example, Price List 25, Transportation, lists pamphlets, reports of commissions, reprints, relating to railroads and shipping problems, postal service, telegraphs, telephones, government ownership and control, that are for sale by the Superintendent of Documents.

THE TELEPHONE IN SOUTH AMERICA

A survey of the telephone and telegraph systems of all the countries south of the Rio Grande has just been completed by the American Telephone and Telegraph Company with the aid of the various governments. This shows that only one telephone for about 300 population is found in the whole area, as compared with 34 for every 300 population in the United States. Argentine leads with 105,205 telephones, or nearly a third of the total. The other countries having more than 10,000 telephones are Brazil, Mexico, Cuba, Chile and Uruguay. It is evident that there is opportunity for much development in South America before the telephone is made the universal means of communication that it is in the United States.

Of the total telephone and telegraph earnings in 1918 in the Latin countries, the telephones brought in only 43.3 per cent of the total and the telegraphs 56.5 per cent. In the United States this situation is strikingly reversed—80.8 per cent from the telephones and 19.2 per cent from telegraphs. The total telegraph wire mileage is 433,938 there and 1,900,000 here.

Problem Course in Electricity

BY H. H. BLISS

(Do you understand your motor? the relation of its construction to its capacity? The principles of magnets are described in the following article, the eighth of the series on practical electricity, which shows how to perform the simpler calculations with flux, losses and ampere turns. The author is on the staff of the Riverside Junior College at Riverside, Cal.—The Editor.)

MAGNETISM

Theory of Magnetism.—When a bar of iron or steel becomes a magnet it is supposed that the tiny particles of which it is composed are more or less aligned to point in one general direction. When the bar is demagnetized the “molecules,” as the particles are called, are released and point in all ways; and if it is remagnetized so that the poles are reversed, they are aligned again, pointing in the opposite

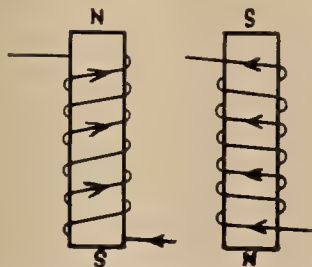


Figure A. Diagram showing how the polarity of a magnet depends upon how the current goes around and not how it goes along the magnet.

direction. In soft steel and iron they turn easily, so that such metals are readily magnetized and demagnetized. In hard steel the molecules turn with difficulty. Hence a magnet of hard metal cannot be made so strong as one of soft metal; but since it keeps its magnetism well, hard metal is used for permanent magnets. In many electrical machines, including motors, generators, and transformers, some parts are magnetized, demagnetized, and remagnetized in the reverse direction many times a second. This requires the expenditure of energy in turning the molecules; the wasted energy is called the “hysteresis loss.”

Any piece of iron or steel in the neighborhood of a magnet is affected by the “magnetic flux” or “lines of force,” becoming itself a magnet. The point at which the flux enters any magnet, temporary or permanent, is called its “south pole,” since this end points southward if the magnet is suspended free to turn. The flux is considered as passing through the metal of the magnet, issuing from the “north pole,” and making a complete closed circuit through the air or other materials on the way to the south pole.

Electro-Magnets.—A coil of wire with an iron core forms an “electro-magnet.” Before current flows the iron shows no evidence of magnetism—it will not pick up pieces of iron or repel a compass needle. But when a current of electricity is made to flow through the coil, around the iron, the iron acts in all ways like a magnet. Note that the current does not flow through the iron; the core is generally insulated from the wire.

As soon as the current is stopped, the iron is found to lose practically all its magnetism. For lift-

ing bars or irregular masses of steel, for separating iron particles from mixtures such as ores, for attracting and releasing the vibrating arms of telegraph sounders, buzzers, and electric bells, the ability to let go is as valuable as the ability to pull. Electro-magnets are often operated from a distance, as in the control of lamps and elevator motors and in signaling.

Furthermore, electro-magnets can be made much stronger than permanent magnets of the same size and weight, and their strength can be varied at will. Hence they are used in nearly all generators and motors, as we shall find in future lessons.

With an electro-magnet the flux or number of force lines depends upon the number of “ampere-turns” in its coil—the number of “ampere-turns” is the product of the number of amperes times the number of turns of wire around the magnet. By increasing the current the flux can be made as great as desired up to the limit of “saturation.” (When the flux in steel or wrought iron reaches about

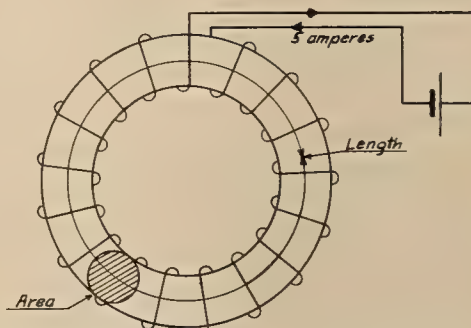


Figure B. Diagram drawn to illustrate the question, How many lines of force will thread this doughnut-shaped coil if the cross section area is 2 sq. inches and the length is 8 in.?

120,000 lines per sq. in. of cross section, the material seems to be saturated, so that increasing the ampere-turns raises the magnetization very little. The saturation limit for cast iron is much lower—about 50,000 lines per sq. in.)

Fig. A shows two simple, bar type, electro-magnets to illustrate the rule for determining “polarity.” “Grasp the magnet with the right hand, fingers pointing around it in the same direction that the current flows, and the thumb will point to the north pole.” As shown in the sketch, the current may enter the coil at either the N or the S pole.

Heating of Electro-Magnets.—Just as in every other conductor carrying current, the coil of an electro-magnet is the seat of an energy loss, where electric energy is converted into heat. It is evident that this heat must in some manner be removed from the coil, or else in continuous operation the temperature would rise to such a point as to injure the insulation.

In many cases the heat is largely radiated from the surface of the coil, but magnets in generators and motors are exposed to drafts of air which carry away much of the heat by conduction. That which is generated in the interior of the coil has to reach the surface by conduction through the metal and insulating materials, and hence the inner turns are always warmer than the outer ones. Coils for this reason are rarely made over two inches deep if intended for continuous operation.

A rise of 72° Fahr. above the room temperature is about as high as is safe for the external surface of a coil. The highest temperature in the interior is then about 54° above the surface temperature, or 126° Fahr. above the room. It is found that in order not to exceed these figures the power loss in the coil should not be over .5 watt per sq. in. of cylindrical surface. (The area at the ends of the coils is considered zero as far as heat radiation is concerned; the .5 watt is in reality partly dissipated from the ends, but the calculation is simpler if it is all credited to the cylindrical surface.) For field magnets of a dynamo machine the fanning cools the surfaces so that values up to 1 watt per sq. in. can be used for short coils in certain cases. The figures in this paragraph apply to coils about two inches thick, impregnated with insulating compound.

What is the highest voltage which can safely be applied continuously to a stationary coil of 1.8 ohms resistance, 2 in. thick, 8 in. long, and 7 in. external diameter? The periphery = $3.14 \times 7 = 22$ in.; the external area = $8 \times 22 = 176$ sq. in. Hence the allowable loss = $176 \times .5 = 88$ watts. Amperes \times amperes \times ohms = 88; amperes \times amperes = $88/1.8 = 49$, and amperes = 7. Hence safe pressure = $7 \times 1.8 = 12.6$ volts.

Calculating Ampere-Turns.—For lifting-magnets, for the poles of generators and motors, for transformers and other electrical apparatus, it is necessary to produce definite quantities of magnetic flux, definite numbers of magnetic force lines. While the definition of the exact meaning of one "line of force" must be postponed for later discussion under "Electric Generators," it is possible here to outline the relations between the total flux and the ampere-turns surrounding the magnet.

Consider the cast of a doughnut-shaped ring made by bending a long coil around until the ends meet (Fig. B). Current in the coil causes lines of force to be set up in the ring-like tunnel (which we will assume has no iron core), and the number will be proportional to the ampere-turns. The larger the cross section area (other things being equal), the greater the flux; the longer the lines, the more ampere-turns will be necessary to produce a given flux. Experiment as well as theory shows the truth of the following relation:

$$\text{"Flux} \times \text{length} = 3.2 \times \text{ampere-turns} \times \text{area"}$$

where the length is in inches and the section area in sq. in.

By simple mathematical processes, similar to those used in transposing Ohm's Law and other electrical formulas, we may change this expression

around to find any one of the factors when the rest are known. For example, if the flux = 600 lines, length of average line = 20 in., cross section of path = 4 sq. in., the ampere-turns are found as equal to $\text{flux} \times \text{length} / (3.2 \times \text{area}) = 600 \times 20 / (3.2 \times 4) = 940$. To get any term standing alone, divide its companions into the other side of the equation.

Solutions of Transformation Problems

78. Ft. lbs. per minute = $8300 \times 660 = 5,480,000$. Divide by 60 and 550 and find hp. output = 166. Input to pump = $250 \times .92 = 230$. Efficiency = $166/230 = 72\%$.

79. Line loss = 300 watts. Amperes \times amperes $\times 3 = 300$; hence amperes \times amperes = 100, and amperes = 10.

80. $2,300,000/2,545 = 904$ hp. hours in 20 hours; $904/20 = 45.2$ hp., average input; $45.2 \times .32 = 14.5$ hp.

81. Input = $100/.90 = 111$ hp. = 83 kw. $83 \times 8 = 664$ kw-hr. $1460/664 = 2.2$ cents per kw-hr.

82. 880 watts give .88 kw-hr. in an hour. $.88 \times 3412 = 3000$ B.t.u. per hour. $3000/4 = 750$ B.t.u. into 8 lbs. of water, or 94 B.t.u. per lb. Since one B.t.u. raises one lb. 1°, the rise of temperature = 94°. $60 + 94 = 154^\circ$ F.

83. Loss = 30 kw-hr. per hour = 102,360 B.t.u. One gallon raised 40° takes $8.3 \times 40 = 332$ B.t.u.; $102,360/332 = 308$ gallons per hour.

84. Since hp. = pull \times speed/550, pull = $35 \times 550/3.5 = 5500$ lbs. Weight = $5500/.70 = 7850$ lbs.

85. $450/5 = 90$ kw-hr. of energy supplied to motor. $90 \times .6 = 54$ kw-hr., output of motor; $54 \times 2,650,000 = 143,000,000$ ft. lbs. of work done.

86. 100 watt-hours or .1 kw-hr. = $.1 \times 3412 = 341$ B.t.u. As there are 384 cu. ft. of air, each gets $341/384 = .89$ B.t.u. Then $.89/.02 = 44.5^\circ$ rise. $50^\circ + 44.5^\circ = 94.5^\circ$.

Magnet Problems

87. A horseshoe-shaped electro-magnet has 350 turns on each leg. The average resistance per turn is .6 ohm. Find the total ampere turns on the magnet when the coils are connected in series on a 130-volt line. (Under these circumstances this magnet can lift 55 lbs., and the cores are practically saturated with magnetism.)

88. Find the ampere-turns on this magnet if its coils are connected in parallel on an 80-volt line. What can you tell about the lifting force under these circumstances?

89. Figure the power consumption and the B.t.u. developed per hour in Problems 87 and 88.

90. Calculate the cylindrical area of a stationary magnet coil 5.5 in. outside diameter and 7.8 in. long. What watt consumption is safe?

91. What voltage is safe to leave connected to this coil if its resistance is 30 ohms?

92. In a generator pole a certain flux is produced by 2.5 amperes flowing through 600 turns of wire. The pole is re-wound with 820 turns of wire having a resistance of 14 ohms. What voltage must be applied to give the former flux in the pole?

93. Find the ampere-turns of an electro-magnet to which a pressure of 120 volts is applied, sending a current of 3 amperes. Each turn of wire has an average resistance of $1/5$ ohm. What is the watt consumption of this magnet? How many B.t.u. does it radiate in one hour?

94. A group of magnets in a generator heats a current of air from 80 to 95° Fahr. If all the heat produced is absorbed by this air and 800 cu. ft. are blown past per minute, what is the watt loss in the coils?

95. What is the external diameter of a magnet coil 7.4 in. long absorbing 160 watts, if the cylindrical surface radiates .8 watt per sq. in.?

96. A coil 1 ft. long is wound on a broomstick $\frac{3}{4}$ in. in diameter, then taken off and bent into a circle. Current sufficient to produce a total of 67 lines of force is sent through the coil. How many amperes flowed through its 150 turns?

97. A coil 30 in. long, of rectangular cross section 2.5 in \times 4 in., is bent into a circle and 13 amperes sent through the 620 turns. What flux is produced? What would be the effect on the number of lines if one filled the turns of the coil with wood? with brass? with iron?

Mechanical Analogs—III.

BY G. R. SCHUCK

(Technical problems are frequently simplified by the use of an analogy. The following article, the last of a series, takes up the mechanical and electrical parallels in resistance, inductance and capacity in series. The author is on the electrical engineering staff of the University of Washington.—The Editor.)

RESISTANCE, INDUCTANCE AND CAPACITY IN SERIES

The three circuits which were shown in parallel in Fig. 3 are now connected in series as shown in Fig. 11, to the same source of alternating pressure. It is evident that the rate of flow of fluid through any part of this circuit must be the same, since the fluid is supposed to be incompressible. Therefore it is desirable to take the curve of fluid flow as a starting point in this analysis. Let I , Fig. 10, be the curve of fluid flow. The pressure at any instant between T and T^1 is divided between the three parts of the circuit, R , C and L . The problem is to determine the time relation between the pressures across L , R and C . It has previously been shown that the wave of pressure exactly coincided with the wave of fluid flow through the long pipe, because there is no absorbing or elastic medium as in C , nor retarding or inertia effect as in L . The fluid pressure consumed in R will therefore be directly proportional to the rate of flow at any instant and can be represented by the curve E_R , Fig. 10, coinciding in time relation with or in phase with curve I .

It is evident that the disc in L and the membrane in C must follow the oscillations of the flow of fluid and move backward and forward in unison. This fact will determine the time relation which the pressures across L and C have to the curve I , and to each other. Choosing the zero point on the curve

a maximum, and just starting to force the disc in the reverse direction. Therefore the pressure in L is a maximum when the fluid flow is a minimum and may be represented by the curve E_L in Fig. 10 and the arrow in Fig. 9. Similarly it is easily shown that the pressure across C lags behind the flow of fluid by one-quarter of a period, and may be represented by the curve E_C , Fig. 10, and the arrow in Fig. 9. Now comparing E_L and E_C , it is found there is a difference in time relation, or phase relation, of two one-fourth periods, or one hundred and eighty degrees, showing that when the pressure in L is a

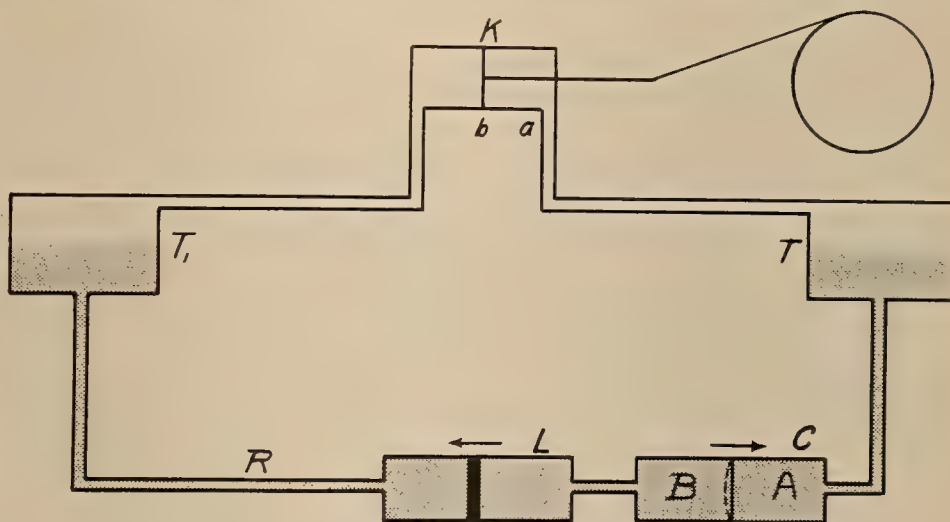


Fig. 9

Diagram illustrating mechanical cycle parallel to electrical cycle illustrated in Fig. 11.

maximum in one direction, the pressure in C is a maximum in the opposite direction.

If the elasticity of M and the inertia of D are made to be of proper value such that the opposing pressures are made equal, these two pressures will at all times balance, and their sum will be zero. Hence under these conditions the supply pressure is all used up in forcing the fluid through the pipe R , and the only thing which limits the flow of fluid is the frictional resistance in this pipe. If this resistance were removed or even greatly reduced, enormous oscillations of fluid would alternate through L , C and R , causing heavy forces to rise in L and C ,

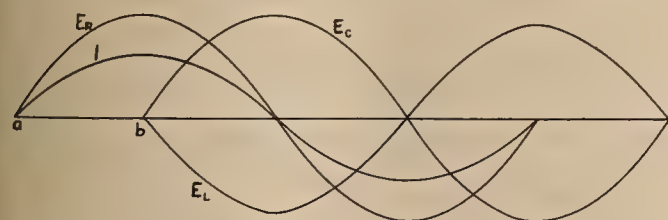


Fig. 10

Curves of pressure and flow in series circuits.

I , such as a , when the disc and the membrane are at one extreme range of oscillation, examine the direction and amount of pressure in L . It has been shown previously that when the disc was in the extreme position of motion, the pressure on the disc is

\$50,000,000 is the estimate of the Los Angeles building permits for the year. The southwest metropolis is fast becoming an important industrial center.

HELP LOS ANGELES
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because of the momentum of D and the elasticity of M. These pressures might become greater than the supply pressure, and sufficient to rupture the membrane M.

The same phenomena which were observed in the foregoing system are also apparent in the system shown in Fig. 11, containing resistance, capacity and inductance in series. The same curve which represents fluid flow and pressure will also represent electric flow and electromotive force as far as time relation, or phase rotation is concerned. A voltmeter connected across either L^1 or C^1 might, under certain conditions, indicate more than the pressure mains, and be sufficient to break down the dielectric M. Values of L^1 and C^1 will be equal though opposite in direction; and a voltmeter across the two in series

might indicate no voltage. Under these conditions the supply voltage is all used up in forcing current through the resistance. This condition in electric circuits is called "voltage resonance."

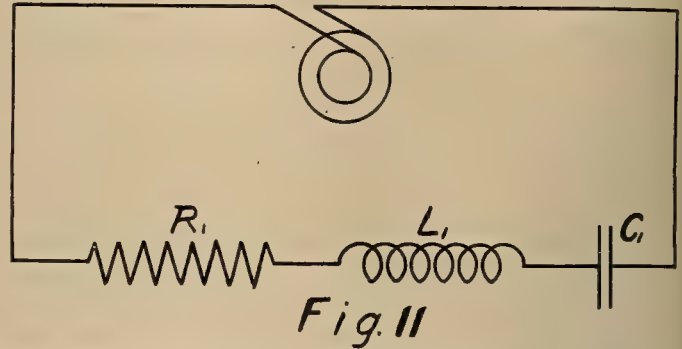


Diagram illustrating operation of resistance, conductance and capacity in series on an electrical circuit.

A Central Fire Alarm Station

BY C. W. GEIGER

(Nothing is more essential to a city's welfare than an efficient system of fire protection, and nothing is more fundamental to an efficient system of fire protection than a reliable fire-alarm central station. San Francisco can claim at present the most complete fire-alarm system ever installed in any city. The following article tells how electric current from storage batteries or from a gasoline-engine driven generator, as well as from power companies, can be used. The details of receiving and sending alarms are also given.—The Editor.)

One of the most important features of San Francisco's fire protection system is the central fire-alarm station in Jefferson Square. The entire fire-alarm system is undoubtedly the most complete and most thoroughly safeguarded that has ever been installed by any city.

The station is of concrete with steel frame, especially designed to withstand severe earthquake shock. It is fireproof, mothproof and burglarproof. In the construction of this station, every precaution

mitted to be constructed within four hundred feet of the station.

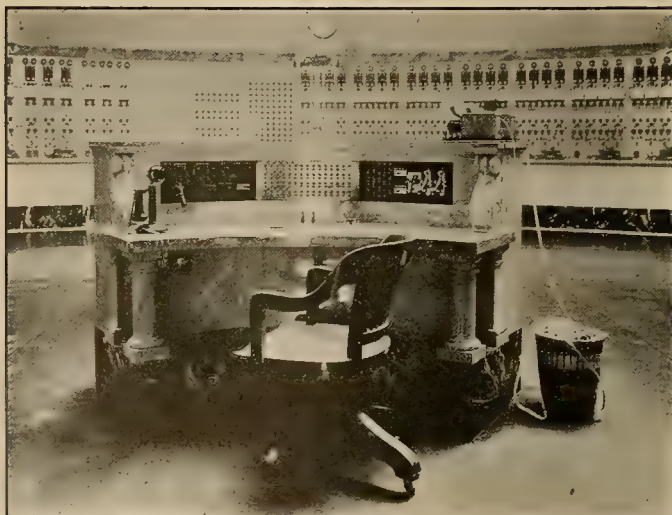
Electrical Supply

There are three sources of supply for electric current, thus insuring the operation of the equipment under all conditions. These sources are: battery, the two public service companies (Pacific Gas & Electric Company and Great Western Power Company), and a gasoline-driven generator. In case the current from outside source is shut off, reliance is placed on the generator. The gasoline-engine is a 20-hp. Fairbanks-Morse type. It is located in the basement in a special room, and in order to eliminate any fire hazard from the engine, it is separated from the rest of the building by a 10-inch reinforced concrete wall.

Large storage capacity for fuel and water has been supplied which will enable this equipment to operate for a long period, without the necessity of obtaining additional supplies from outside. Duplicate storage batteries of 280 ampere-hour capacity supply current for operating the circuits on the main switchboard. In case the outside source of current is shut off, the battery is capable of operating all equipment for a period of 10 hours. In order that one set of batteries may always be held in reserve, two sets are provided. The batteries may always be held in reserve, two sets are provided. The batteries can be charged from the direct-current or the alternating current mains of the two different power companies.

The Operating Switchboard

The main operating switchboard is 102 feet in length, semi-circular in form, and is divided into three sections. There are now 48 working signal circuits, and a number of joker circuits. The station has an ultimate capacity of 80 signal circuits, sixteen



Alarms are received on the signal circuits mounted on the main switchboard shown in the background. Alarms are sent out to the engine houses by an operator from the desk in the foreground.

possible was taken to protect the intricate electrical equipment from everything that might interfere with its efficient operation. Being located in the central part of Jefferson Park, it is almost entirely free from fire hazards from surrounding buildings, and from falling chimneys, etc. No buildings are per-

tapper circuits, sixteen alarm circuits, and sixteen joker circuits. The main operating switchboard comprises 41 panels, each panel being one inch thick, thirty inches wide and four and one-half feet in height, and constructed of Vermont Electric Blue marble. The semi-circular form of the main switchboard makes it self-sustaining.

Five panels on the main switchboard are devoted to "hospital" circuits. In case of trouble, such as open lines, grounded lines, and lines crossed up with outside circuits, they are switched on to the "hospital" circuits, which have better facilities for making tests than the regular operating circuits. Three tapper and three joker and six signal circuits can be handled at one time by the hospital circuits. Lines that may be in trouble are connected to the hospital circuits by means of plugs and jacks in a manner similar to that used by the ordinary telephone operator in making telephone connections.

At the present time there are 858 fire-alarm boxes, which are connected with the fire-alarm station by means of cables, carried in conduits of the telephone companies, the high-pressure piping system ducts and the ducts of the Department of Electricity. All cables terminate at manholes just outside the station, from which point they lead to a terminal rack, located in the basement, immediately under the main switchboard. From the terminal rack the wires are carried to the main switchboard, through three runways, one runway leading to each of the three sections of the switchboard.

Receiving Alarms

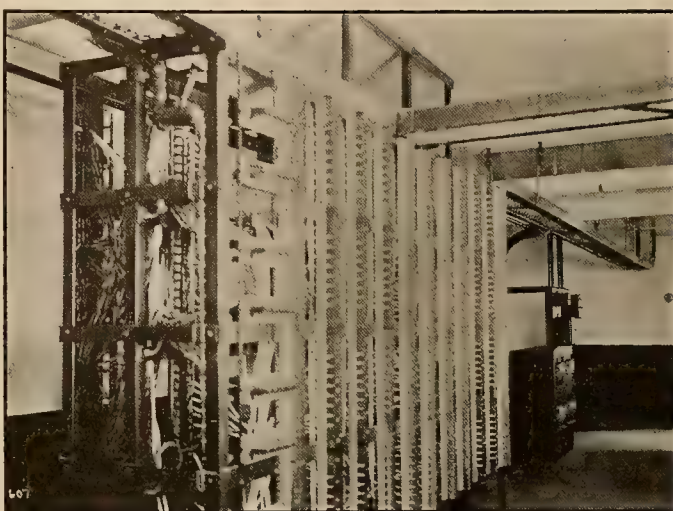
All alarms from the street boxes are received at the central station on telegraph sounders and registers, no provision being made for the transmission of alarms directly from the fire-alarm boxes to engine houses. Each fire-alarm box is equipped with a clock mechanism and a character wheel. In turning in a fire alarm, all that is necessary is to pull down once on the hook. This releases the clock mechanism, and permits the character wheel to revolve four times before stopping. Each revolution of the character wheel sends in one alarm to the central station. Two men are required to operate the main switchboard, one operator being stationed at the main desk and the second at the registers, on the main switchboard. There are 48 incoming circuits for receiving alarms from the 848 fire-alarm boxes. Some of the incoming circuits carry as many as 40 fire-alarm boxes, while others only carry four, but the average number is 20 boxes to a circuit. At the present time an effort is being made to reduce the number of boxes to each circuit. The fire-alarm box number is shown on an illuminated box list (illuminated only when an alarm is being received), which is placed on the incoming circuit. A pilot light is placed immediately above this box list, which operates with the register, flashing the same code, calling attention of the operator in case he should fail to hear the sounder.

When an alarm from a fire-alarm box is being turned in, the operator at the desk calls out the number as he hears it, and at the same time the box number is checked on a list by the operator at the

board. In order to verify the number, the operator at the board repeats the number as he hears it. If this tallies with the number as called by the man at the desk, the man at the desk immediately sends out the alarm to all the engine houses that are detailed to respond to that particular box number.

Clearing Traffic

If the operator at the desk finds that any of the fire engines will have to cross Market street, or make a run up or down Market street, he immediately throws a switch which operates the large warning bells on Market street. When these bells sound all traffic clears the streets, and all pedestrians remain on the sidewalks, and the traffic officers or policemen in the vicinity of the bells proceed to provide a right-of-way for the coming fire apparatus.



All cables terminate in manholes, first outside the station, from which point they lead to the terminal rack shown above. This is located in the basement immediately under the main switchboard. Two runways can be seen above the rack. Through these wires are carried to the main switchboard.

In order to guarantee that all fire apparatus has passed or crossed Market street, the bells sound for three minutes on all first alarms, and longer for second and third alarms.

Communication From Alarm Boxes

Each fire-alarm box is equipped with a regular telegraph service key and sounder. By means of this the battalion chief or his assistant can communicate with the operator at the central station. This renders very valuable service when the battalion chief desires additional engines, chemical wagons, or to increase the pressure at any hydrant connected with the high pressure system.

High Pressure Protection

The area in San Francisco that is protected by the high pressure system is divided into two zones: the lower zone, which includes those portions of the

\$700,000,000 will be required in the next ten years to finance necessary construction work to meet the growing power requirements of the West.

HELP THE POWER COMPANIES
PUT IT OVER

protected area less than one hundred and fifty feet in elevation, and the upper zone, which includes all those portions of the protected area, the elevation of which is more than one hundred and fifty feet.

Each of these zones is supplied with water under pressure up to about one hundred and fifty pounds from its own distributing reservoir. When necessary the mains of the upper zone may be connected with the Twin Peaks reservoir and the pressure raised to two hundred and eighty-four pounds or less, depending upon the elevation.

The mains of the lower zone may be connected with the reservoir of the upper zone or with the Twin Peaks reservoirs whenever pressures higher than ordinary are required.

It often happens that it becomes necessary to increase the pressure at a hydrant very quickly. The battalion chief signals the operator at the central station by means of the telegraph service key, and informs him that he wants a certain reservoir connected with the zone. The operator at the central station immediately telephones the operator at the particular reservoir, who opens the proper valves which increases the pressure at the hydrant. The entire operation often requires less than a minute. In ordering out additional engines, or chemical wagons, the operator at the central station sends out the proper signals on the joker lines.

Private Telephone Connections

The central fire-alarm station has private telephone connections with all fire-houses, pumping stations, reservoirs, and every department of the Fire Department. Connections with these departments are made through a telephone switchboard located in the building, and manned by an operator at all times. In the Olympic Club building fire-alarm bell and registers have been installed for the accommodation of fire department officials when using the bath and gym. An auxiliary fire-alarm box has been installed in the San Francisco Hospital to enable the attendants to turn in an alarm of fire without leaving the building.

THE OIL CONSERVATOR

BY W. C. SMITH

(The latest development in oil immersed transformers, described here by a transformer sales engineer of the General Electric Company, is of especial interest to men of the West where this type of transformer is used extensively. Those who know the faults of the oil transformer will appreciate the announcement that the Oil Conservator eliminates "breathing," tends to avoid the possibility of explosion and to eliminate oil decomposition.—The Editor.)

In oil immersed transformers, the oil performs two functions, that of an insulating and of a cooling medium. To preserve these qualities it is necessary to maintain its dielectric strength and its ability to circulate freely. The Oil Conservator has been developed for preserving these qualities of transformer oil. It will also prevent deterioration of the solid insulation and will eliminate explosions due to the ignition of combustible gases which may collect above the oil in the ordinary transformer tank.

The oil conservator consists of an auxiliary tank mounted above the main tank and connected to its highest point by a suitable pipe. Under operating conditions the oil completely fills the main tank. The size of the auxiliary tank is governed by the expansion and contraction of the oil due to changes in temperature. At the lowest operating temperature, the oil must not contract so as to allow air to enter the main tank and at the maximum temperature the oil must not overflow the conservator.



The Oil Conservator which is a new form of tank for static transformers

The pipe between the two tanks is of such a section that oil expansion will take place without allowing free circulation of oil.

The presence of moisture in transformers has a most harmful effect, not only on the oil but on the solid insulation. Oil having a dielectric strength of 22 kv. between one-inch disks spaced 1/10 inch apart contains not more than eight parts of water in one million parts of oil. An additional 10 1/2 parts of water, or a total of 18 1/2 parts per million, will reduce the dielectric strength to 16 1/2 kv., which is the lowest permissible limit for use in large or high voltage transformers.

Since the main tank is always full of oil under a slight pressure, air can not be drawn in through joints in the main tank which may not be tight, and the natural breathing due to the change in transformer temperature will affect the oil level in the auxiliary tank, where any condensation of moisture must take place. The condensation of moisture in the auxiliary tank is reduced to a minimum by the use of a breather or calcium chloride drying chamber, but should the breather be improperly cared for or even neglected entirely, the condensed moisture will fall to the bottom of the auxiliary tank where a sump is provided. The oil exchanged between the two tanks is taken from a point well above the sump and is practically free from moisture.

Preservation of Insulation —

Not only does the oil conservator preserve the insulating quality of the transformer by preventing moisture from entering the main tank, but it prolongs the life of the transformer by materially retarding the deterioration of the fibrous insulation such as cotton paper and fibre, which ordinarily takes place at the higher operating temperatures. As a specific illustration, accelerated life tests have shown that the deterioration of such insulations when operated at 105° C. with the oil conservator, is not greater than when the same insulations are operated without the oil conservator at 95° C. or less.

SPARKS—Current Facts, Figures and Fancy

(The last word in banking, theater lighting, fishing, navigation, hatching, and taxi bills appears on this page. Those who enjoy large scale pictures will be interested in plans for making one of the California coast, and the foreign trade and bigger business enthusiast will be delighted over the report of our Mexican trade and new buildings constructed last year.—The Editor.)

We are often inclined to grumble at the taxi bill, but then it helps to consider the prices in Petrograd where the fare for half an hour's ride in a taxicab is 2,000 roubles, which is the equivalent of nearly \$1,000 in American money at normal exchange.

* * *

If you can't decide whether you like it wet or dry, go to a certain one of the Hawaiian islands where the rain falls at the swamping rate of one inch per day at one point and at the most conservative rate of twenty inches to the year at another.

* * *

A recent 4100-mile conversation is reported as having broken all records of long distance talking. Both wire and wireless telephones were combined to make possible a conversation between Avalon, California, and the steamer Gloucester, off Philadelphia.

* * *

The sea bank is the latest innovation of the financial world made possible since money can be transferred by wireless. An extra large safe has been made a part of the "Imperator's" equipment and drafts on shore banks are honored and the money transferred by radio.

* * *

California's nut crop is growing to enormous proportions. The 1920 walnut crop will total not less than 46,000,000 pounds, valued at from \$10,000,000 to \$31,000,000. But estimates do not stop there for shelled walnuts and by-products of walnut shells will bring the growers from \$1,000,000 to \$2,000,000 more.

* * *

It takes 17,637 lamps with a total of 451,010 watts to light the world's largest theater which has just been completed in New York. Interior illumination reaches its highest point of beauty here where canary, amber, blue, red and white lamps are all used in every conceivable way to produce the desired effects.

* * *

Switzerland never ceases to astound us with her progress in hydroelectric development. She now reports over 16,000 generating plants to a population of less than 4,000,000. In addition to power and lighting, electricity is now being used to a great extent for heating and cooking, in private houses as well as in institutions.

* * *

Plans are being laid for photographing the entire coast of the state of California by airplane. These plans are the result of the successful trip of three F-5-D navy seaplanes from San Francisco to San Diego in six hours and forty-five minutes. The ease with which this trip was taken proves that this

type of plane can well be used for making a picture of the coast.

* * *

The electrically hatched chick will soon bring down the prices of eggs, according to a report from Portland which predicts a third of a million chickens per season as the output of the electrically-operated chicken farm known as "Henacres." This very year with a load of 36.5 kilowatts something like 100,000 chickens will be hatched.

* * *

Fish as well as forests are the favored subjects of airplane patrol. Fishing craft off the east coast of the United States are directed to the most promising schools by an accompanying plane which goes ahead with pilot, observer and radio operator. It is reported that record catches are being made under the modern fishing method.

* * *

High costs or no high costs, buildings must go up, as shown by statistics recently gathered for the year 1919. 377,000 buildings were erected during this year in the larger cities of the United States. The total cost of this construction is estimated at \$1,300,000,000 which makes the 1919 record the highest yet reached in the building industries.

* * *

In spite of all disturbances the trade of the United States with Mexico is heading for the \$300,000,000 line in the fiscal year 1920. On the import side, \$40,000,000 worth of sisal, a substitute for hemp, heads the list and \$26,000,000 worth of crude petroleum comes second. The biggest export items are \$7,000,000 worth of iron pipe and \$6,000,000 worth of cotton cloth.

* * *

No one has taught us a more valuable lesson than the rags-bottles-sacks man. He was the first to make a business of saving the waste. A small part of the result of this lesson is the sale, during the past ten years, of more than \$14,000,000 worth of fuel briquets made from waste coal and waste petroleum residue. In fact briquets are becoming so popular that the Susquehanna river is to be dredged for refuse coal to be used in their manufacture.

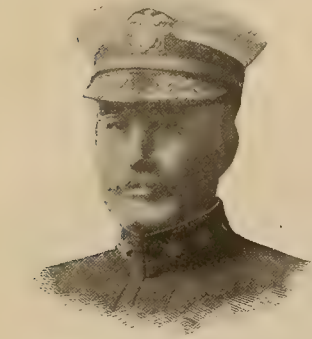
154,000,000 acre-feet is the annual discharge of the Columbia River at the Dalles. This is only one of the water powers whose energy Portland hopes to utilize in its program of developing industry.

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PERSONALS

Admiral Joseph Lee Jayne, former commandant of the Twelfth Naval District and recently made commandant of the

Pacific Train Fleet of the Pacific Fleet, has contributed inestimably to the development of the West in presenting feasible plans for and urging the construction of a causeway from Oakland to Goat Island for the purpose of making the latter a great bay terminal. A map presented elsewhere in this issue of the Journal of Electricity pictures the enormous industrial, financial and commercial center which will be made



possible by the actual fulfilment of this project which has been the dream of the Bay region since 1869. After his graduation from the U. S. Naval Academy, Admiral Jayne studied at Johns Hopkins University where he received a certificate in applied electricity. During the Spanish-American war he was commander of the torpedo boat Rogers and since that time has been commander of various vessels including the U. S. S. New Jersey and Mississippi and Division Three, Battleship Force 1, of the Atlantic fleet. In September, 1918, he was made commander of the Twelfth Naval District, holding that position until his recent transfer to the supply division of the Pacific Fleet.

Douglas Drysdale, an electrical engineer of Scotland, is now in San Francisco.

George O. Muhlfield, vice-president and general manager of the Stone and Webster Company of Boston, Massachusetts, is a recent San Francisco visitor.

E. B. Bumsted, consulting electrical engineer of San Francisco, recently spent some time in Colorado with the Hermann Engineering Company, where he was engaged in the development of oil shale in the commonwealth of Colorado.

F. W. Brownell, general accountant of the Puget Sound Power & Light Company, Seattle, recently returned to his offices from Boise, Idaho, where he attended the Northwest Conference of Statistics and Accounts held in that city.

C. B. Hawley, general manager of the Inter-Mountain Electric Company of Salt Lake City, returned from a business trip to East Pittsburgh, Penn., during which he visited the factories of the Westinghouse Electric & Manufacturing Company.

J. W. S. Butler, formerly vice-president and general manager of the Western States Gas and Electric Company with headquarters at Stockton, California, is now Pacific Coast representative of Henry L. Doherty and Company and will have his headquarters in San Francisco.

P. H. Ducker, superintendent of transportation for the Southern California Edison Company, left Los Angeles on October 9 for a short trip to Eastern points for the purpose of studying traffic problems, particularly referring to the use of motor trucks. He will visit New York, Chicago, Boston, Philadelphia and Denver.

L. S. Ready, assistant chief engineer, California Railroad Commission, has been appointed a member of the executive committee of the San Francisco chapter of the American Institute of Electrical Engineers to take the place of W. G. Vincent, valuation engineer of the Pacific Gas & Electric Company, who has resigned.

Virginia Fairfax, librarian of the Carnation Milk Products Company, with headquarters in Chicago, and who has been contributing the interesting series of articles in indexing and filing that have appeared in the columns of the Journal of Electricity, will return this winter to California where she will give a course on the subject of filing of pamphlets and clippings at the Riverside Library School during January and February.

Herman Jansson, Lieutenant in Corps of the Swedish Royal Engineers, stopped in San Francisco during the past week as part of his visit to the West for the purpose of keeping in touch with the advancement of industry and the development of water power in this section of the United States. Mr. Jansson intends to return to Sweden via the Panama Canal. He is a member of the Swedish Royal Board of Waterfalls, Stockholm, Sweden.

O. B. Coldwell, vice-president of the Portland Railway, Light & Power Company, has been appointed a member of the Industrial Lighting Committee of the National Electric Light Association. This new committee of the Association was formed due to the great interest being taken at the present time in industrial lighting and it is the plan of the committee to take a lighting exhibit similar to the one that was shown at the last N. E. L. A. convention around the country.

Y. Furukawa, director and chief engineer of the Kyushu Electric Light and Traction Company, Fukuoka, Japan, is making an extended visit throughout the West for the purpose of studying power company systems. Mr. Furukawa has already visited San Francisco and Salt Lake City, where he studied particularly the system of the Utah Power & Light Company. Seattle, Butte, Chicago and New York City are other points to be visited. Mr. Furukawa states that he intends purchasing some electrical machinery in New York.

L. P. Hockett, auditor and accountant with the Public Utilities Commission of Utah for the past two years, has resigned to accept a position with the Public Service Commission of the state of Washington. Mr. Hockett has been especially active in obtaining betterments in the accounting of public utilities before the state commissions. He was instrumental in bringing about a conference recently at Boise, attended by representatives of the accounting departments of the Washington, Oregon, Montana, Idaho and Utah commissions, at which a uniform system of accounting to be put into effect in the various states represented was taken up.

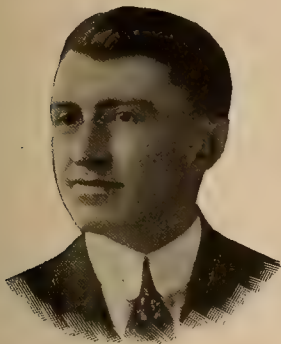
Roy C. Kenney, manager of the Portland office of NePage-McKenny and Company, was the host at the recent

convention of the Oregon State Association of Electrical Contractors and Dealers, in his position as president of that organization. Mr. Kenney has held this office for two years and has just been re-elected for another term. Mr. Kenney started to work on the Pacific Coast in Seattle for the Agguter-Griswold Company and when that company went out of construction work in 1910 and began manufacturing he



joined with the NePage-McKenny and Company which was formed at that time, and since then has represented the firm in Spokane, Seattle and Portland where he has been located for the past four years. Under the guidance of Mr. Kenney the contractor-dealers of Oregon have been very active in the promotion of the cooperative spirit among the different branches of the industry and in raising the standard of their own particular branch.

C. A. Semrad, general manager of the Western Light and Power Company of Colorado, was elected president of the Colorado Electric Power and Railway Association at their recent convention which was held in conjunction with the Rocky Mountain geographical division of the National Electric Light Association. Mr. Semrad graduated as an electrical engineer from the University of Wisconsin with the class of 1908 and for a time was instructor in hydraulics and water power at that university. He then entered the employ of the Union



Light and Power Company of St. Louis for a year, leaving them to become a cadet engineer with the Northern Colorado Power Company, which position he held until 1914. The next four years were spent as general manager of the Cheyenne Light, Fuel and Power Company, a subsidiary of the Western Light and Power Company, and in 1918 Mr. Semrad was promoted to the position of general manager of the holding company. The election of Mr. Semrad as president of the Colorado Electric Light, Power and Railway Association assures the cooperation of this body with the newly formed Rocky Mountain division of the N. E. L. A. which should bring about long strides in the electrical industry in Colorado in the coming year.

F. R. Whittlesey, secretary of the Oregon Association of Electric Contractors and Dealers, is calling on the members throughout the state in the interests of the association.

W. R. Putnam, vice-president and general manager, Idaho Power Company, with headquarters at Boise, Idaho, has returned to his office from a four weeks trip in Eastern centers.

C. H. Delany, steam power plant specialist for the Pacific Gas & Electric Company, has been investigating and visiting a number of the larger steam power plants in Southern California.

Iwao Nesaka, chief electrical engineer of the Kyushu Hydroelectric Company of Kyushu, Japan, has recently made a tour of the Pacific Coast to investigate the systems and practices of long distance transmission.

C. M. Holliwell of Tolledo, Nebraska, is the new manager of the Windsor office of the Western Light & Power Company, Colorado. Mr. Holliwell is succeeding **W. R. Shade** who has been transferred to the office in Loveland, Colorado.

Major Houck, assistant supply sales manager, and **Judge Appleton**, chief counsel of the General Electric Company, in company with **T. E. Bibbins**, president of the Pacific States Electric Company, recently visited Portland while making a tour of the Pacific Coast.

J. I. Colwell, Seattle manager of the Western Electric Company, was in attendance at the recent convention of the Oregon Contractors and Dealers' Association where the subject of the Northwest Electric Service League was under discussion and so forcefully endorsed.

A. W. Leonard, president of the Puget Sound Power & Light Company, Seattle, left Seattle on October 17 for a week's trip covering the state of Washington with the Seattle Trade Relations Tour. There were approximately 125 Seattle business men, covering all interests, in the party.

L. H. Harvison, vice-president and sales manager of the M. W. Kellogg Company, is spending some time in the West, particularly in visiting industrial activities in and about the Bay of San Francisco. Mr. Harvison is interested in a process for cracking hydro-carbon components of crude petroleum in addition to the activities of the Kellogg Company.

M. C. Osborn, who is well known on the Pacific Coast, due to his long association with the Pacific Gas & Electric Company and the Washington Water Power Company, has been appointed Utilities' Representative of the Gillespie Eden Corporation with headquarters in New York.

R. C. W. Libbey is leaving on November 7 to attend the annual sales meeting of the Simplex Electric Heating Company at Cambridge, Mass., to return about the first of the year. He will stop en route at Los Angeles, Salt Lake City, Boise and Denver to attend to business for his company.

D. J. Young, vice-president of the Tacoma Gas Light and Fuel Company, has just completed a trip through California investigating operating conditions in the various power companies which have gas plants. Mr. Young was formerly connected with the San Diego Consolidated Gas and Electric Company.

Dr. Frederick E. Moll, commercial manager of the Bernese Light & Power Company of Berne, Switzerland, is a recent Pacific Coast visitor and is spending some time in investigating the hydroelectric situation in the West. Dr. Moll's company is one of the largest electrical power companies in Switzerland.

R. F. Sullivan, manager of the Tacoma Railway & Power Company, of the Stone & Webster interests, and **K. C. Schluss**, superintendent of power and equipment of the same company, attended the convention of the American Electric Railway Association held at Atlantic City from October 11 to 15. Before returning to Tacoma they visited the Boston offices of Stone & Webster.

Frank B. Rae, consulting engineer and one of the pioneers in electric development in the West, has returned to



San Francisco where he will establish himself as a consulting electrical and mechanical engineer specializing on heating and ventilating problems. Mr. Rae was connected with the Western Union Company as electrician of the Pacific Coast division from 1877 to 1880 and had charge of the installation of the duplex and quadruplex overland circuits. From 1880 to 1883 he was connected with the Brush Electric Light Co. as electrical engineer in San Francisco and while with that company built the first plant of the San Jose Electric Light Co. and acted as general manager of that company. Mr. Rae then left for the East where he helped build the present form of ticker used in the New York Stock Exchange and did some pioneering in the field of electric railway construction. In 1888 Mr. Rae became engineer for the Detroit Electrical Works and built the Detroit street railway system which was known as the Rae system. Since that time he has had offices in Detroit, Chicago, New York and Cleveland as consulting engineer and he has now decided to come to the West where more electrical development is taking place than anywhere else in this country.

OBITUARY

William Waters, one of the best known figures in San Francisco contracting and building circles, died October 17. Mr. Waters was active in the rebuilding of many of the principal office buildings of San Francisco until 1913 when he was made Chief of Building Construction at the Panama-Pacific Exposition and Manager of Buildings during the Fair. In 1917 he had charge of the construction of Camp Fremont. For three years Mr. Waters had been a member of the engineering firm of Baker, Carpenter & Waters.

HAPPENINGS IN THE INDUSTRY

FUNDAMENTAL COST-ACCOUNTING STUDY PLANNED FOR NEXT YEAR

The Advisory Committee of the California Electrical Cooperative Campaign has adopted the plan of the Journal of Electricity and the extension division of the University of California of giving to the contractor-dealers a clear conception of just what cost-accounting is. It is the intention of the Journal of Electricity to publish a series of articles, beginning early next year, prepared by Prof. Henry R. Hatfield, dean of the college of commerce of the University of California and a prominent authority throughout the nation on accounting, covering the fundamentals of cost accounting and book-keeping agreeable to the national system of standardized accounts adopted by the National Association of Contractors and Dealers some time back. Prof. Hatfield will be assisted in the research work necessary in this study by a graduate student of the university.

POWER APPLICATION FILED FOR UPPER KLAMATH LAKE IN OREGON

Roy W. Swicart, president of the Shasta Valley Irrigation Project, Montague, Cal., has filed with the state engineer of Oregon, an application covering the storage of 1,600,000 acre-feet of water in the Upper Klamath Lake for the irrigation of land and the development of power in California. A short time ago an application was filed by Mr. Swicart on behalf of the project covering the appropriation of 1500 second-feet of water in the Klamath River for irrigation and power development.

UTAH COMMISSION ORDERS SPECIAL POWER CONTRACTS TO BE MADE STANDARD

The Public Utilities Commission of Utah has just rendered a decision effective October 22 whereby all existing special power contracts of the Utah Power and Light Company customers in Utah are declared discriminatory and ordered placed on standard schedule. This is the result of a hearing in a special contract case which was held at the order of the Commission, and means an additional annual revenue to the power company of approximately \$1,000,000. In all probability the power customers will appeal to the state Supreme Court and the case may possibly go to the United States Supreme Court.

DEVELOP ALASKA WATER POWER SITES TO RELEASE PAPER PULP SUPPLIES

From one-third to one-half the annual needs of the nation in paper pulp supplies would become available through the development of the large amounts of water power still untouched in Alaska, according to a report of the United States Forestry Bureau. Development of this water power would make 40,000,000,000 feet of paper pulp material available at the rate of approximately 1,200,000 tons per year.

In the timber area from which the paper pulp would come the following water power sites in Alaska have been investigated: Fish Creek, 10,000 hp., using water from three storage lakes; Swan Lake, 9,000 hp., with several storage lakes; Malia Bay, 5,000 hp.; Beaver Falls, 5,000 hp. with storage; Shrimp Bay, 7,000 hp., one storage lake; Bailey Bay, 6,000 hp., and several storage lakes; Mill Creek, 4,000 hp., and other nearby sites; Karta River, 4,000 hp., small lake; Hetta Inlet, 4,000 hp., with several small lakes at high altitudes; Thomas Bay, 28,000 hp., 15,000 hp. continuously; Sweetheart

Falls, 15,000 hp. with large storage lake; Long Lake, 20,000 hp., and Crater Lake, 10,000 hp.; Treadwell, 12,000 hp., already developed; Mitchell Bay, 10,000 hp.; Warm Spring Bay and Cascade Bay, 5,000 hp. each; Silver Bay, 6,000 hp.

SAN JOAQUIN ISSUE OVERSUBSCRIBED THREE TIMES

The \$2,625,000 of 8 per cent Convertible Trust Bonds of the San Joaquin Light and Power Corporation which were recently placed on the market in San Francisco were oversubscribed three times the first day. These bonds were Series D, dated November 1, 1935, are redeemable at 104 and interest, and were issued in denominations of \$500 and \$1,000. Their purpose is to refund the floating indebtedness accumulated in the construction of the Kerckhoff Power House and the additions to the Bakersfield steam plant. These two additions increase the generating capacity of the company 70,000 horsepower.

HEAVY OCTOBER SNOW FALL IN SIERRA MOUNTAINS

According to Weather Bureau statistics, more snow has fallen in the Sierra Mountains this month than in any October since 1878, with the exception of the year 1899. While 89 inches of snow fell at Summit, California, twenty-one years ago, forty-one inches has fallen in the first two-thirds of the month of October, 1920. The mean snow fall for October is given as 13.6 inches.

As early season snow is of much more value than snow which falls late in the season, there is every reason for power companies throughout the coast states to be optimistic on their supply of water for next year. Rain fall in good volume is reported generally among the coast states in October, and supplies of water for power purposes have increased to the extent that former power is in most instances available.

IDAHO COMMISSION RULES ON HEATING

Public Utilities Commission of Idaho has granted authority to the Idaho Power Company, Boise, Idaho, to make its schedule No. 14-A of rates for air and water heating effective for all customers, dated October 1. This is equivalent to granting a 30 per cent increase in rates for this class of service throughout its entire territory. Permission was also given the company to refuse to new customers more than 4-kw. connected load for air or water heating.

The commission concluded that the use of electricity for heating air and water for domestic purposes is not feasible. This finding, together with the fact established by the company that the equipment necessary for heating service is needed for power uses, and cannot be confined to heating service without operating at a loss, governed the commission in granting the increased rates.

POWER RESTRICTION LIFTED IN CALIFORNIA

Recent rains have made possible the lifting of the ban on the use of power in the northern and central parts of California. Power Administrator H. G. Butler on October 11 removed all restrictions against the use of power except the restriction on skip-stop and that restriction was lifted on October 18. According to the Commission, there will be no return to the restrictions unless there is a dry fall, in which event the power companies and the public will again be placed

on a limited allowance of electricity. Not since last June, when the need for power conservation became apparent, have the power companies been free from strict regulation. The situation in the state from a power standpoint is considered satisfactory and the Commissioner advised that there is no longer any need for curtailing the use of electricity.

LOS ANGELES CITY RATES INCREASED

With the adoption by the City Council of Los Angeles of ordinance No. 40890, all rates for electric service in the city were increased 12½ per cent, effective October 11. This followed a long discussion and will tend to relieve the situation brought about by increased operating costs, and which affected companies operating in the city. The former maximum lighting rate of 5.5 cents becomes 6.2 cents and the maximum power rate is increased from 4.5 to 5.1 cents, all other rates being increased in the same proportion. Consumers of the Los Angeles Gas and Electric Corporation, the Southern California Edison Company and the City Bureau of Power and Light are affected.

EXTRACTS FROM PUBLIC UTILITY COMMISSION CASES IN 1920

A summary of many of the most striking statements by utility commissions in deciding cases granting relief to public utilities of some of the Western states during the present year has been sent out by the Publicity Committee of the N. E. L. A., with the belief that the points considered will be of benefit to many companies now considering the matter of rate increase. Of the seventeen state commissions throughout the country which have granted relief to public utilities to date this year, the following are quotations from some of these cases which affect utilities in the West:

IDAHO POWER COMPANY, June 2: "Obtaining money for a further investment when that already made is not yielding a compensatory return is difficult and the time when the preparations must be made for the new demand is now." Increase.

SOUTHERN CALIFORNIA EDISON COMPANY, April 15: "It is vitally necessary for the continued growth and prosperity of the vast territory in Southern California supplied by this company with electric energy that its full program of electric development go forward without serious interruption. We believe it to be in the interests of the consumers that they pay rates sufficiently reasonable to enable the company to earn a fair and reasonable return upon the actual investment. Unless this is done it is plain that the utility cannot borrow sufficient funds to carry forward necessary development." Increase of 27 per cent.

MISSION RANGE POWER COMPANY, February 20: "Despite abundant power, no one else seems willing to undertake the hazard of developing it, and those who have made the risk are entitled to a minimum to a fair return upon their investment." Increase.

ARIZONA, telephones, rates and charges: "We do not believe that it was intended that the regulatory powers vested in this commission should be used to the disadvantage or inequity of the public utilities of the state, and we believe we can render a greater service to the citizenship by giving rates which, while they are just and reasonable to the public, will enable the company to maintain a standard of service fully equal to public necessities and provide for extensions of service which will encourage rather than retard the growth and development of the state." Increase.

OREGON COMPANY FILES FIRST COMPLETE WATER POWER APPLICATION

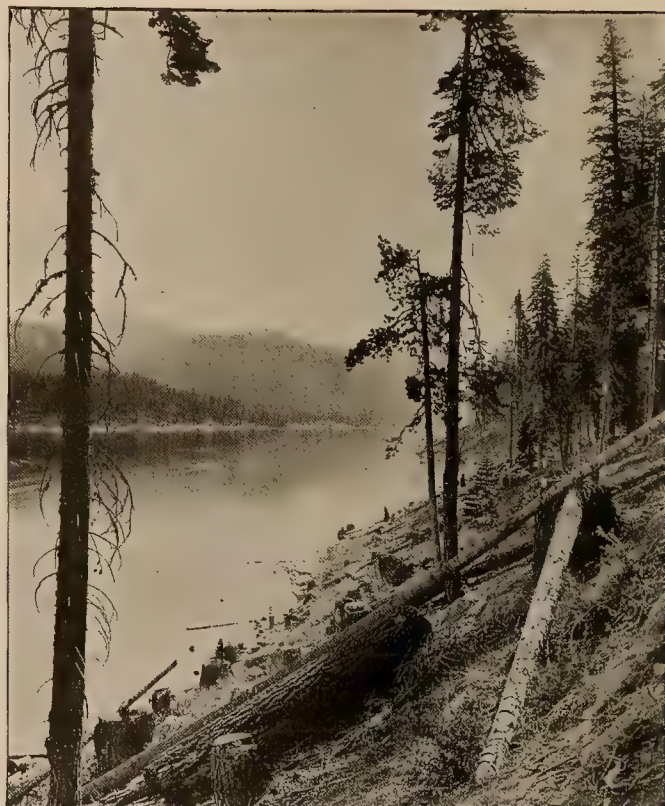
The Columbia Valley Power Company, which plans project work on the Deschutes River in Oregon, is the first company to make an application absolutely completed and perfected so as to conform with the regulations issued by the Federal Power Commission. This application was among the latest received but was applied for in person by C. D. Charles of Denver who had all the necessary data in his possession to enable him to make out a complete application. In this he was assisted by Col. William Kelly, the engineer officer of the Commission. Certain information is still lacking in each of the other applications which have been filed as these Federal regulations were issued after the applications were made out. It is expected, however, that the preliminary permit for the Washington Irrigation and Development Company for its project on the Priest Rapids of the Columbia River, Washington, will be completed very soon.

NEWSPAPER MEN VISIT BIG CREEK PROJECT OF SOUTHERN CALIFORNIA EDISON COMPANY

(On the hearty cooperation of the press much of the success of the great power program of the West depends. One of the first important steps towards securing this cooperation was recently taken by the Southern California Edison Company as described below.—The Editor.)

Practically every newspaper in southern and central California was represented in a party of inspection sponsored by the Southern California Edison Company in connection with its two hundred million dollar construction program in the Big Creek region.

The party left Los Angeles Friday evening, October 8, by special train, arriving in Fresno Saturday morning where



Huntington Lake Reservoir at an elevation of 7000 feet, and with a storage capacity of 88,400 acre feet, supplies Big Creek Power House Nos. 1 and 2, each with an installed capacity of 32,000 kw.

San Joaquin Valley editors joined the excursion. From Fresno the special was run to El Prado where the passengers transferred to the San Joaquin and Eastern Railway for Cascada.

Three days were spent in going over the Edison properties with Huntington Lake Lodge as headquarters. The editors, seventy in number, were unanimous in the opinion that the future expansion and prosperity of the state are very closely allied with the power program. For the first time, these men had the opportunity of studying the problems of hydroelectric development. Tunnels, dams, power-houses and transmission lines acquired a new meaning. They went over

5,500 different industries are located in the San Francisco-Oakland district. The development of a great industrial center in the San Francisco Bay region is the plan of the next few years.

**HELP SAN FRANCISCO-OAKLAND
PUT IT OVER**

the ground and followed the watercourses which will yield 750,000 hp. when the fifteen-year program is finished.

Two evening meetings were held. At the first, company officials explained in detail the future plans for power which call for the completion of new plants at the rate of 50,000 hp. annually for the next fifteen years. The need for local support in a financial way was demonstrated and the importance of rates sufficient to maintain a sound financial statement which will encourage further investment of Eastern capital was made clear. At the second meeting the Pasadena Convention film "That Fairy in the Snowflake" was presented, followed by an open forum.

As a result of the trip the press of California will have a clearer conception of the power resources of the state and the necessity of their complete utilization. The members of the party were as follows:

F. W. Tenney, San Pedro News; C. F. Waits, San Pedro Daily Pilot; E. C. Wickhizer, South Pasadena Record and Courier; C. H. Connor, Star-News, Pasadena; E. S. Kellogg, Pasadena Evening Post; A. T. Richardson, Pomona Daily Progress; R. L. Driscoll, Pomona Daily Bulletin; Crombie Allen, Ontario Daily Bulletin; E. L. Howell, Chino Champion; J. P. Baumgartner, Santa Ana Register; M. A. Yarnell, Santa Ana Bulletin; W. O. Hart, Orange News; W. L. Taylor, Orange Star; Paul Hester, Anaheim Plaindealer; W. L. Rideout, Placentia Courier; J. J. Conrad, Huntington Beach News; Everett J. Horsely, Anaheim Herald; Paul Moore, Redlands Facts; Frank Arthur, Redlands Facts; C. B. Irvine, Culver City Call; Walter W. Rennie, Vanguard News; S. E. DeRankin, Santa Monica Outlook; George Orgibet, Redondo Breeze; C. H. Turner, Redondo Reflex; F. A. Johnson, Hermosa Beach Review; J. V. Van Eaton, El Eegundo Herald; G. F. Reinhart, Covina Citizen; E. V. Jensen, Azusa Pomotropic; C. O. Broyon, Monrovia Messenger; Azusa Pomotropic and Arcadia Journal; R. B. Kennedy, Whittier News; Ed. Van Matre, Downey Champion; A. V. Douglas, Brea and La Habra Star; Cecil Wilcox, Lankershim Lancer; Frank Keffer, Van Nuys News; R. C. Harbison, San Bernardino Sun; C. A. Welscher, Suburban Home, Watts; W. L. Lefavor, Watts Advertiser; Wm. G. Gilstrap, San Gabriel Sun; Wendell P. Chambers, Alhambra Federated News; Archie J. Hicks, Palmdale Post; J. J. Krouser, Oxnard Courier; C. F. Hoffman, Moorpark Enterprise; Tobias Larson, Fillmore Herald; W. E. Wagener, Fillmore Herald; T. C. Holt, Santa Barbara News; A. A. Smith, Visalia Daily Times; W. S. Clawson, Exeter Sun; John G. Ropes, Woodlake Echo; Larry Smith, Hanford Journal; J. Mitchell, Hanford Sentinel; John A. Rollins, Tulare Daily Advance; H. A. Charters, Tulare Daily Register; F. C. Rhodes, McFarland Weekly; Mrs. F. C. Rhodes, McFarland Weekly; W. A. Hawley, First National Bank, Delano; Earl R. Clemons, Terra Bella News; John R. Bell, Porterville Recorder; J. R. Gould, Strathmore Sentinel; A. L. Evans, Lindsay Gazette; Wesley Barr, Los Angeles Herald; Alexander Tulley, Los Angeles Express; E. K. Hoak, Los Angeles Financial News; Burton Knisely, Los Angeles Record; Denton Crow, Los Angeles Associated Press; O. T. Palmer, Hollywood Citizen; John King, Pres. Pub. Ass'n, Hemet; Edward Fairchilds, Los Angeles Examiner.

"SAY MERRY CHRISTMAS ELECTRICALLY"

"Say Merry Christmas Electrically" is the idea which the Society for Electrical Development intends to sell to the holiday shopper through the big drive they are now starting.

The feature of the campaign material to be issued this



An illustration which shows a suggested method of using the window display cut-out which the Society for Electrical Development is issuing for the use of the electrical dealer.

year will be the five-piece window display cut-out. This set will be lithographed in eight colors. It will be of such a nature that it will be appropriate in any size or shape of window. With the cut-outs will be included full illustrated instructions for making the most instructive use of the material.

An innovation will be attractively hand-lettered invitations for merchants to mail to prospective customers urging them to visit their shop and see the display of electrical Christmas gifts. These will be printed in two colors on folded sheets of note paper, envelopes to match being supplied.

There will also be folders and booklets describing and illustrating many different electrical gifts, lantern slides and popular poster stamps. The poster stamps will carry the design used on the central panel of the window display cut-outs.

In the Holiday Campaign issue of the Sales Service Monthly there will be from 15 to 20 newspaper advertisements. Every ad suggestion is illustrated and cuts or mats of the illustrations will be supplied by the Society upon request.

The Society states that any electrical merchants believing that it will not be necessary to make a particular effort are doomed to disappointment. There is business to be had—but it must be sought. Merchants in other lines are realizing this and will make unusual efforts to secure their share of the holiday trade.

MORE PREFERRED STOCK TO BE ISSUED

BY P. G. & E.

Pacific Gas & Electric Company is offering its first preferred stock, to yield 7½ per cent on the investment. This is in line with a recent order of the California Railroad Commission authorizing an issue of \$1,000,000, proceeds to be applied to part payment of construction expenses. Authority has been asked to issue \$5,000,000 of this stock.

SAN JOAQUIN LIGHT & POWER APPLIES FOR PERMIT ON BEAR CREEK

Application has been made by the San Joaquin Light & Power Corporation to use a hundred second-feet of water from Bear Creek. According to the plans the company intends to spend \$1,200,000 on the construction of a dam 1600 ft. long which will store 21,000 acre-feet of water and develop 8,400 hp.

WESTINGHOUSE AND SIMPLEX HEATERS NOT INFRINGEMENTS ON MAJESTIC'S PATENT

The cases for infringement of patent of the Majestic Electric Development Company, San Francisco, Cal., against the Westinghouse Electric & Manufacturing Company and Holbrook, Merrill & Stetson, agents for the Simplex Heating Company, were recently tried in San Francisco with the result that while the court did not hold that the Majestic patents were invalid, it was held that the Westinghouse and Simplex heaters were not infringements. The Majestic company advises that it will immediately appeal to the United States Circuit of Appeals this decision of the United States District Court at San Francisco. The Majestic company also advises that suits will shortly be brought against other companies in defense of the same and other patents.

OREGON INDUSTRIAL COURT IS PROPOSED

Settlement of all industrial disputes and regulation of industries by three judges to be appointed by the governor is the purpose of a bill which will be presented for consideration at the next session of the legislature. The judges, according to the proposed measure, will constitute a court of

industrial relations, and the appointment of the personnel must be made with the advice and consent of the senate.

Although the proposed bill will be copied to some extent from the industrial court law enacted in Kansas, that feature of the measure providing for the abolishment of the public service commission will probably not be followed. It is likely, however, that if enacted the bill will merge the affairs of the present public service commission with the tribunal of industrial relations to avoid any duplication of effort.

ADVERTISING OF HYDRO PROJECTS PRIOR TO COMPLETION OF APPLICATION PERMITTED

The Federal Power Commission has authorized the advertising of the applications for licenses under the Water Power Act of the Crown-Willamette Paper Company of Oregon and the Pit River Power Company of California prior to the completion of their respective applications. Construction is already under way in the latter case and in the former case, because of the serious shortage of paper in California, the rule was departed from in order that preliminary construction on a pulp and paper project might begin at an early date.

CONTRACTOR-DEALER BUSINESS IN SAN FRANCISCO IN 1919

Results of a questionnaire recently sent out to contractor-dealers in San Francisco show some estimated financial figures for the year 1919. Although all contractor-dealers did not respond, returns were received from twenty-six generally known to be responsible for most of the work placed in the city. Capital invested, \$769,208; gross business, \$2,111,113; payroll, \$583,498; material purchased, including supplies and stock, \$1,735,530.

PASADENA TO INVESTIGATE HYDROELECTRIC PROJECT

Authorization has been given by the City Commission of Pasadena, Cal., to T. W. Koyner, general manager of the Municipal Lighting Department, and Samuel B. Morris, chief engineer of the Municipal Water Department, to investigate a project near that city which it is expected will bring from 15,000 to 25,000 hp. in hydroelectric energy.

RECORD OIL PRODUCTION IN CALIFORNIA IN SEPTEMBER

The September production of all oil companies in California of 304,340 barrels a day established a record figure for the state, according to a statement of the Standard Oil Company in California. Daily production of 302,400 barrels in June, 1914, was the highest previous figure recorded. New production in the Elks Mills, it is said, was mainly responsible for the large figure. While fifty-five new wells were completed in September, with an initial daily production of 21,775 barrels, stocks decreased by over 275,000 barrels in the month.

SAN DIEGO APPLIES TO ISSUE SECURITIES

The San Diego (Cal.) Consolidated Gas and Electric Company on October 20 applied to the Railroad Commission for authority to issue \$500,000 of its first mortgage five per cent gold bonds and \$604,000 of its preferred stock. Both issues are to go to the San Diego Electric Railway Company and the United Light, Fuel and Power Company in payment for the power plant of the railway company and the steam heat distributing system of the United. Both of these corporations have applied to the Railroad Commission for authority to sell their plants to the San Diego Consolidated Gas and Electric Company.

SOUTHERN SIERRAS AND HOLTON COMPANIES GRANTED RATE INCREASES

On Sept. 17, the Railroad Commission of California authorized the Southern Sierras Power Company and the Holton Power Company to increase their rates for electric energy in an amount which will provide a return estimated at 8.4 per cent. The added cost to the consumers of the former company will approximate 19.2 per cent, while that to the Holton consumers will be about 10.4 per cent. Both companies being jointly owned, the increase to the public on the combined systems will approximate 16.5 per cent. The new rates for lighting and cooking became effective on Southern Sierra Power Company's meter readings of Sept. 20, while the power rates will be effective Nov. 1. Meanwhile a 20 per cent surcharge is to be collected. In the case of the Holton Company, new lighting and cooking schedules are effective Sept. 20 and power schedules on Oct. 31, with a 15 per cent surcharge collected in the meantime.

The Sierras Power Company is directed by the Commission to charge the Nevada-California Power Company one cent per kw-hr. for all energy delivered for resale to the Nevada customers of the utility. The Nevada company owns four of the plants (and transmission lines) operated by the Sierras company, and their rental is fixed by the Commission at \$500,000, as against charges under a leasing arrangement totaling \$596,732. Immediate installation of a meter to measure power sold to the parent company is ordered by the Commission.

In discussing service in the Imperial Valley, referring to the two steam stand-by plants of the Holton company and the conditions that make continuous steam operation there uneconomical, the Commission holds that large consumers requiring continuous service must install their own stand-by until the growth of load justifies an investment sufficient to install sufficient capacity.

"However," says the Commission,

"the service in the valley is continually growing and it is apparent that definite steps should be taken at this time toward bettering the quality of service being rendered even if this requires considerable investment on the part of the utilities. Either a standby plant sufficient to carry the essential loads, which can be put in operation at a shorter notice than the present plants, should be planned or an additional source of power should be arranged for. The companies owe an obligation to their consumers in the Imperial Valley to take steps to this end and it will be expected of them that they present to the Commission not later than January 1, 1921, a practical plan of improving the service."

Regarding the rule of the companies, approved by the Commission, covering the financial demands of the companies in connection with service extensions, the Commission says:

"It does not appear that a modification of the rule is justified at the present time due to financial difficulties existing, with the exception that, pending final decision of the Commission, Holton Power Company and Southern Sierras Power Company should make all extensions without charge to applicant for lighting service where the cost of the same does not exceed \$80 per consumer."

"Under the circumstances," it is added,

"it is reasonable for the companies to call upon applicants desiring service to assist them by the advance of moneys, it being understood, of course, that where the entire cost of an extension is advanced the company will pay interest thereon in cases where the company will make the extension without advance were money available. The demands for power developments to meet the growth of business on the company's system is taxing them to the full extent of their ability to cover the cost of power plant construction and general transmission and distribution additions."

"A logical districting of the company as regards rates for lighting service," says the Commission, "would be to

\$150,000,000 in crops can be raised annually on the arid lands which will be irrigated by the Colorado River Project and over one million people can be supported on this territory—later to become electrical customers.

HELP THE LEAGUE OF THE SOUTHWEST TO PUT IT OVER

divide the system of Southern Sierras Power Company into five districts, as follows:

- "(1) The territory north of San Bernardino mountains.
- "(2) The territory south of the San Bernardino mountains, excluding Coachella Valley and the city of San Bernardino.
- "(3) Coachella Valley.
- "(4) City of San Bernardino.
- "(5) City of Blythe."

The Commission, in declining to exempt Coachella Valley from the increase and in answer to the claim of the Coachella Valley consumers that they can not afford to pay more for power, suggests that the Sierras company waive existing contractual rights in the event that individual consumers find it more economical to use other forms of power.

The new rates, according to the Commission, are fixed on a valuation of \$7,618,541 for the Southern Sierras Company and \$1,111,500 for the Holton Company, or a total valuation of \$8,730,091 for both. The Commission estimates that the gross operating revenue of the Sierras company for 1920 will total \$1,696,020; Holton company \$618,550. Combined revenue, \$2,314,570. Combined gross operating expense, \$1,644,480 divided as follows: Sierras company \$1,141,410; Holton company \$503,070.

COAST VALLEYS ELECTRIC REQUESTS BOND ISSUE

The Coast Valleys Gas & Electric Company, San Francisco, Cal., on October 14 applied to the California Railroad Commission for authority to issue \$375,000 of its first mortgage, 6 per cent, forty year gold bonds. According to the application, the proceeds are to be used to reimburse its treasury for money spent out of earnings for improvements and betterments and to provide funds for planned improvements to the company's system throughout Monterey county. The company estimates that it will require approximately \$84,000 to complete work already under way and that improvements planned but not yet started will call for an expenditure of \$323,580.

Among the planned electrical improvements are: Increased capacity of 4000-volt feeders in Salinas Valley, \$20,000; distribution line extensions next twelve months, \$12,000; new outdoor high-tension substation at Salinas, \$15,000; new distribution substations east and west sides of Salinas Valley, \$30,000; duplicate transmission line from Metz to King City, \$25,000; convert Soledad-King City line from 30 kv. to 60 kv., \$30,600; total, \$132,600.

TRADE NOTES

Combination For Insulator Research —

An arrangement has been made whereby the General Electric Company has acquired an interest in the Locke Insulator Corporation. The officers and directors of the corporation are:

Donald Symington, president; John F. Symington, vice-president; F. H. Reagan, vice-president; W. G. Hoffman, Jr., treasurer, and J. F. Douty, secretary. The directors, in addition to the president and two vice-presidents, are G. E. Emmons, C. W. Appleton, D. R. Bullen, J. W. Upp, George P. Baldwin, C. J. Symington and Walter T. Goddard.

This arrangement will result in engineering and research cooperation between the two companies with respect to insulator problems. The manufacturing facilities of the Locke Company will be greatly increased upon the completion of its new plant at Baltimore early next year.

Western Electric's High Volume of Business —

Sales of the Western Electric Company are running at a higher rate than at any other period in its history, according to a recent report from the company. For eight months of the current year its domestic billing showed a total volume of \$119,500,000.00, indicating domestic sales for the year approximately \$190,000,000.00. This does not include export business nor sales of its foreign affiliated companies.

Pacific Coast Office Established —

The Manistee Iron Works Company of Manistee, Michigan, have established a Pacific Coast District Office in the Rialto Building, San Francisco. The district will be in charge of Mr. L. M. Page, general sales manager for the past five years. Branch offices will shortly be opened at Los Angeles, Portland and Seattle.

Retrospect of Fan-Motor Season —

An optimistic view of the fan-motor situation is contained in a statement just issued by the Fan Motor Section of the Associated Manufacturers of Electrical Supplies. It is stated that the left-over stocks in the South are very low, in the West quite small, in the Southwest below normal, on the Pacific Coast low, while in the East the stock is a bit larger than usual, due in a measure to unfavorable weather conditions having set in which tended to prevent the jobber and dealer from disposing of stocks. However, a line drawn between the East and West would show a normal left-over stock of fans.

It is thought that this left-over stock will not have any appreciable effect on the trade next year and manufacturers are very optimistic about the future fan-motor business, particularly regarding its use in the home. Efforts are to be made to emphasize to the trade through various mediums the uses of the fan in winter so as to make it an all-the-year-round utility device instead of a seasonable luxury, as it has been regarded by many. Most of the manufacturers are planning for an increased production of from 20 to 25 per cent and one in particular is planning for a 40 per cent increase. Some of the smaller manufacturers, while not planning for an increased production, are keeping up to the 1920 schedule.

Certain difficulties are being experienced in securing raw materials, particularly foundry products. Wire is now easier. The situation is by no means normal yet, as the manufacturers see it. Work on the production of fans is carried on throughout the year and manufacturing orders for 1921 stock were placed last winter. It is hardly believed that there will be any recession in prices this year, in fact, there will probably be some increases. There have been no decreases in the price of labor or raw materials and much raw material was purchased last winter when the prices were at top notch. It is felt that jobbers can be of great assistance in aiding manufacturers to move stock by placing orders for fans earlier in the year than they have been accustomed to doing, and in this connection manufacturers expect to issue their price schedules earlier this fall than they usually do. A big demand is expected for 8, 10 and 12-inch sizes, while ceiling fans have just experienced a phenomenal run and are expected to run high next year.

Sales Agent Moves West —

H. Alex Hibbard, who has for the past three years been general sales agent for the T & W Universal Plug Co. with offices at Chicago, has resigned his position and will return to Denver to look after the interests of Alex Hibbard, Inc., electrical sales engineers, of which company he is president.

New Store in Long Beach —

The J. W. Lane Electric Company formally opened their new store and showroom in Long Beach a short time ago. This company's new home, which is located at 201-205 East Third Street, is modern in every respect and follows the recommendations of the California Cooperative Campaign in its arrangements, although Mr. Lane has introduced many novel and distinctive features. The following comment, made by Mr. Lane to a local reporter, is interesting:

"Distinction in the shop, in its equipment, its service, display, and its general appeal to the public is the ideal. In operating I shall attempt to supply everything the public demands. I have learned the value of this through seeing one man grow from an unimportant person to the biggest merchant in a large middle western city by this policy."

Meeting Notices for Electrical Men

(A review of the many accomplishments of the California Cooperative Campaign and a summary of the comprehensive plans for the future are included in the report of the Advisory Committee of the Campaign which appears on this page. A landmark among engineering activities in the West is the announcement of the 1921 A. I. E. E. Salt Lake Convention which appears here along with news of a Pacific Coast Radio Convention.—The Editor.)

California Cooperative Campaign Advisory Committee Makes Report

The Advisory Committee of the California Electrical Cooperative Campaign met during August and planned an extensive advertising campaign for the Christmas holiday season. It was decided to assume direct charge of all the electrical home exhibits in the future, instead of leaving this in the hands of local groups in each city. Preparatory plans were made for the organization of a speakers' bureau to tell the electrical story, and especially the hydroelectric development story, to all commercial, civic and women's clubs in California. This work the Advisory Committee intends doing in collaboration with the Publicity Committee of the Pacific Coast Section of the N. E. L. A.

In the committee's report on electrical homes, it is shown that results have already been reported in the electrical industry which are especially gratifying to the Campaign. Already realty men are building new homes which follow quite closely the plans of the electrical homes, and architects and contractors have been working with the construction engineer of the Campaign and report increased enthusiasm on the part of house owners and prospective builders for a higher grade of wiring and for more outlets. In Oakland it is reported that every builder has increased the number of his outlets 50 per cent and in Los Angeles electrical contractors report a 20 per cent increase in number of convenience outlets being provided. If the Campaign has done nothing more, it has awakened the people and those interested in building to the actual necessity of more outlets than appear in the ordinary lighting fixture and the effort is already beginning to bear fruit.

It has not been the intention of the Campaign in these model homes to install the last word in wiring. It has been their aim, however, to put in the best wiring job that can be commercialized. The wiring in the San Francisco, Sacramento and Oakland homes cost \$700, \$250, and \$500 respectively.

It is of interest to note the number of persons who visited these homes in the periods of two weeks in which they were open. In round numbers 20,000 persons visited the San Francisco home, 10,000 at Sacramento and 30,000 at Oakland. Of a special value to contractors and retailers is the list of live prospects which was obtained from the Oakland home, where approximately 10,000 names were registered on cards provided for that purpose. In San Francisco about 8,000 persons registered.

The quality of the crowds attracted by the electrical homes has been very high. Practically all visitors are people who own or are intending to build or buy homes. Another interesting angle of the electrical home is that every real estate firm which has had an electrical home has already made request that others be held on their property. Other real estate companies have requested the opening of homes in their districts.

Arrangements are being made to open homes in Los Angeles, Long Beach, San Diego and Fresno before the end of this year. Of the two homes projected in Los Angeles, one is being built of adobe at an expense of about \$40,000, and is said to be the first two-story adobe house to be built in Los Angeles within the last fifty years.

In the matter of publicity, the Campaign is preparing a series of ten illustrated lectures on the electrical home, room by room, which will run in fifteen of the largest newspapers in California from the first of November until the first of January. With these stories the Campaign not only hopes more thoroughly to sell the electrical home idea, but also to increase the demand for electrical appliances during the Christmas season.

Salt Lake City Gets 1921

A. I. E. E. Convention

At a meeting of the Board of Directors of the A. I. E. E., held in Philadelphia October 8, it was decided to hold the 1921 Annual Convention jointly with the Pacific Coast Convention at Salt Lake City, Utah, during the week beginning Monday, June 20th.

The principal argument in favor of combining the two conventions, as advanced by the Pacific Coast Convention held in Portland last July, was the desirability of bringing the eastern and western members of the Institute together occasionally for an interchange of ideas, instead of holding two conventions each year, namely, the annual in the eastern portion of the country attended by a few of the far western members, and the Pacific Coast convention attended by only a few

BUILDERS OF THE WEST—LXXXVIII



RAPHAEL WEILL

The enterprise and enthusiasm which have characterized the engineering progress of the West have their counterpart in the field of retail merchandising where they have made possible the rapid upbuilding of outstanding commercial enterprises. It is this same spirit which has resulted in such institutions as the California Electrical Cooperative Campaign, widely recognized today as one of the most distinctive achievements of the electrical industry in the West. To Raphael Weill, vice-president of the White House Company, San Francisco pioneer in merchandising, this issue of the Journal of Electricity is affectionately dedicated in appreciation of his contribution to the West in establishing and maintaining those high standards in commercial life which have become so fundamental a part of the Western vision of today.

200,000 people are expected to visit Electrical Homes in California before the first of the year and \$20,000 will be spent in advertising these projects, according to recent estimates of the California Electrical Cooperative Campaign.

HELP THE CALIFORNIA ELECTRICAL
COOPERATIVE CAMPAIGN PUT IT OVER

eastern members. The records show that no annual convention of the Institute has ever been held west of Omaha and none west of the Mississippi river since the St. Louis convention in 1904.

Pacific Coast Wireless Men to Convene in San Francisco in November

The first Pacific Coast Radio Convention and Show will be held in San Francisco November 25, 26 and 27 for the Army, Navy, Department of Commerce, Shipping Board, Radio Manufacturers, Radio Clubs and Associations, and amateur radio operators. With a slogan of "Fair play for the amateur and commercial operator," the San Francisco Radio Club expects that new standards will be set in the art, development of apparatus outlined and the good-will of western radio be promoted.

Montana Power Holds Electric Show

The first annual electric show of the Montana Power Company was held at Butte, Montana, October 4 to 8, which it was estimated more than twelve thousand people attended. While the amount of merchandise sold during the demonstrations was gratifying to the firms participating, the show was intended primarily as an educational exhibit rather than a merchandising proposition. It is expected that the show will be made an annual event there in the future.

Utah A. I. E. E. to Help Organize Engineering Council of Utah

The Utah Section of the A. I. E. E. at its meeting of October 15 approved the proposed constitution of the Engineering Council of Utah and agreed to cooperate with the other engineering societies in effecting a permanent organization.

An interesting paper on "The Outstanding Features of the 1920 Convention" was presented by H. T. Plumb, official delegate to the Annual Convention, who also reported on the Pacific Coast Convention. In connection with this latter convention, Mr. Plumb expressed the opinion that in one respect in particular it was more satisfactory than the Annual Convention, namely, that there were fewer papers and more time allowed for discussion and for getting acquainted with the other delegates.

The Section also filed a petition asking that the sphere of its activities and membership be extended from its present limitation of sixty miles radius of Salt Lake City to include all qualified electrical engineers from the southern border of Utah to St. Anthony, Idaho.

San Francisco Electrical Retailers Hear Talk on Advertising

The regular semi-monthly meeting of the San Francisco Electrical Retailers' Association was held on the evening of October 13. Rollin C. Ayers, advertising manager of the Zellerbach Paper Company and past vice-president of the Associated Ad Clubs of the World, spoke on "Cash Drawer Value of Better Business Practices," and told of the work that was being done by the Associated Ad Club and Better Business Bureaus to keep advertising truthful. He dwelt at length on the necessity for straightforward advertising in the newspapers and reminded the members of the Association that newspaper advertising was not the only kind of advertising, but that a satisfied customer who would talk favorably about the service received at their stores was one of the best advertisements they could possibly have.

Synchronous Club Holds Interesting Meeting

"One of the best meetings which has been held in the last two years," was the verdict of over 100 members of the Los Angeles Synchronous Club following the gathering of October 12. Two highly entertaining and instructive addresses were given. The first was presented by Lieut. H. E.

Barden, U. S. N., who discussed the recent voyage of the German submarine U.B. 88. Lieut. Barden was navigating officer on this cruise which was made for the purpose of observing any features of these boats which may be adopted by this country. In the talk particular attention was devoted to the electrical features of the boats, both for operation and signaling.

A very clear account of modern automatic substations was given by G. B. Korker, engineer for the Westinghouse Electric & Manufacturing Company. Mr. Korker described the five automatic stations now in service for the Pacific Electric Railway. These are rotary converter outfits of 1000 kilowatts capacity.

Seattle A. I. E. E. to Hear Exposition of Light Theories

At the regular monthly meeting of the Seattle Chapter of the A. I. E. E. on November 16 J. D. Ross, superintendent of the Municipal Light and Power System, Seattle, will present an illustrated paper on "Radiant Energy and Its Relation to Matter, Space and Time." Mr. Ross will present experiments to demonstrate his theories that light travels in curves, that the magnetic line is the axis of a light wave, and other theories.

Mare Island Trip Planned For November 4th

The San Francisco chapter of the American Society of Mechanical Engineers is making definite plans for a trip to the Mare Island Navy Yard which will be held as part of the celebration to commemorate the fortieth anniversary of the society. The members of the local A. I. E. E., A. S. C. E. and the American Chemical Society are being invited to join the A. S. M. E. with their ladies on this excursion.

The party will leave the morning of the 4th on the 9:45 Monticello steamship. After a tour of the Navy Yard the party will visit the super-dreadnaught "California" which is nearing completion.

P. G. & E. Employees Hear Talk on Opportunities

The Pacific Service Employees' Association of the Pacific Gas & Electric Company, San Francisco, held its Oakland meeting on October 12, the address being given by Robert Sibley, editor of the Journal of Electricity, on "What the Future Holds for Public Service Employees."

Pacific Coast N. E. L. A. Engineering Committee Plans New Work Ahead

The Engineering Committee of the Pacific Coast Division, N. E. L. A., meeting in San Francisco on Aug. 26, got a good start on its plans for the coming year, although the work was not fully outlined. The committee is especially desirous of securing for presentation at the Annual Meeting individual reports from such members as may be engaged in new and specialized work. G. E. Armstrong was appointed permanent secretary of the committee. Tentative dates have been fixed for the next meeting for Nov. 4, 5 and 6, in the Edison Building in Los Angeles, the first day to be taken up with a meeting of the Engineering Committee and the succeeding days with a series of meetings of the Pacific Coast Technical Sub-Committees.

After a discussion of possible topics for general papers for the spring convention, it was decided that a series of descriptive papers be prepared covering the major power developments in the Pacific Coast Division that are in progress of construction this year. Chairman Klauber appointed the following men to take care of articles covering work under construction by their respective companies: P. M. Downing, Pacific Gas & Electric Company; H. A. Barre, Southern California Edison Company; Carl Heintz, City of Los Angeles; J. A. Koontz, Great Western Power Company.

Several topics were outlined for presentation and committees were appointed to prepare papers on these topics, as follows:

Power necessities and resources of California covering both steam and hydraulic sources, with approximate costs and quantities involved. P. M. Downing, chairman.

Factors affecting the fixing of rates on a power factor basis. J. P. Jollyman, chairman.

Live wire maintenance with particular reference to the practices of Pacific Coast companies. Referred to the Pacific Coast members of the Overhead Systems Committee with the suggestion that these members collect data and send it in to the Overhead Systems Committee chairman.

Study of relay and relay systems to cover the problems introduced by large interconnected systems combining steam and hydro stations. E. E. Stauffacher, chairman.

Progress on the development of 220,000-volt transmission. J. A. Koontz, chairman.

A symposium of operating difficulties. Referred to a committee consisting of the load dispatchers of the several companies.

Thirty-three-thousand-volt triplex underground distribution. Carl A. Heintz.

Reports were received from the Line Code Committee, the Safety Code Committee, the Insulator Test Committee and from the chairmen of the several committees of the Pacific Division Technical Committee. In addition, the re-organization of the Association into divisions and the new plan for committee representation was outlined by the chairman.

Manufacturers Attend N. E. L. A. Executive Committee Meeting For First Time

Representatives of electrical manufacturers for the first time attended the National Executive Committee meeting of the N. E. L. A. at National Headquarters on Sept. 1. Under the new classification adopted at the Pasadena convention E. W. Rice, president of the General Electric Company, E. M. Herr, president of the Westinghouse Electric & Manufacturing Company, and W. A. Layman, president of the Wagner Electric Manufacturing Company, were appointed members of the committee. The first two members were present but transportation delays prevented the appearance of Mr. Layman.

The national budget was presented and approved, while a gain of 287 members over the past year was reported. The two remaining big meetings of the year will be held in December and March, but no action was taken regarding the place at which the 1921 convention will be held.

Indorsement was given to the recent action of the American Water Works Association in its approval of the grounding of secondaries of electric light systems to water-piping systems.

New Members of the A. I. E. E.

The large proportion of Western men appearing in the list of those recently elected to membership in the American Institute of Electrical Engineers indicates the increasingly active part this section of the country is playing in Institute affairs.

Henry S. Peck, sales engineer, A. H. Cox & Co., Seattle, Wash., was elected to membership.

Transferred to Grade of Member —

Donald C. Barnes, manager, Seattle Division, Puget Sound Power & Light Company, Seattle, Wash.; Willis T. Batcheller, electrical and mechanical engineer, Seattle Municipal Light and Power System, Seattle, Wash.; William F. Durand, professor of mechanical engineering, Stanford University, Stanford University, Cal.; Llewellyn Evans, superintendent of electric works, City of Tacoma, Tacoma, Wash.; John A. Koontz, Jr., electrical engineer, Great Western Power Company, San Francisco, Cal.; Alvin A. Miller, manager, power and railway divisions, Westinghouse Electric & Manufacturing Company, Seattle, Wash.; Roy R. Robley, operating engineer, Portland Railway Light & Power Company, Portland, Ore.

Transferred to Grade of Fellow —

Reinier Beuwkes, electrical engineer, Chicago, Milwaukee & St. Paul Railroad Company, Seattle, Wash.; George R. Murphy, manager, Pacific district, Electric Storage Battery Company, San Francisco, Cal.

Associates Elected —

John Bankus, electrical engineer, Portland Railway Light & Power Company, Portland, Ore.; Andrew G. Betts, meter superintendent, Puget Sound Power & Light Company, Tacoma, Wash.; Herbert A. Boring, sales agent, General Electric Company, Seattle, Wash.; Robert Q. Brown, acting instructor in civil engineering, University of Washington, Seattle, Wash.; Leslie W. Calvert, chief electrician, Weyerhaeuser Timber Company, Everett, Wash.; Leon H. Chamberlain, switchboard engineer, The Pacific Tel. & Tel. Company, San Francisco, Cal.; Lester L. Conrad, laboratoryman, Southern California Edison Company, Los Angeles, Cal.; Alvin F. Darland, chief electrician, Todd Dry Dock & Construction Corp., Tacoma, Wash.; John A. Fletcher, assistant district manager, Canadian General Electric Company, Ltd., Vancouver, B. C.; Clarence C. Gifford, electrical engineer, Los Angeles Shipbuilding & Drydock Company, San Pedro, Cal.; James L. Green, engineer, Northern Electric Company, Ltd., Regina, Sask., Canada; Charles D. Herrold, Street Car Industrial Co., San Jose, Cal.; William Hubbert, electrical foreman, Skinner & Eddy Corporation, Seattle, Wash.; Clarence L. Johnson, telephone engineer, The Pacific Tel. & Tel. Co., San

COMING CONVENTIONS

ELECTRICAL SUPPLY JOBBERS' ASSOCIATION

Semi-Annual Meeting—Cleveland, Ohio
November 17, 18, 19, 1920

PACIFIC COAST RADIO CONVENTION

The First Pacific Coast—San Francisco, Cal.
November 25, 26, 27, 1920

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS

Annual Convention—Salt Lake City, Utah
June 20-26, 1920

Francisco, Cal.; William C. Kinderman, chief electrician, Holt Mfg. Co., Stockton, Cal.; Vernon E. McCain, salesman, Western Electric Company, Tacoma, Wash.; George I. McFarland, superintendent, Jordan Steam Station, Utah Power & Light Company, Salt Lake City, Utah; Ernest E. McKeen, electrician, Portland Railway Light & Power Company, Portland, Ore.; A. M. McMillan, storage battery salesman, Western Electric Company, Seattle, Wash.; Zadoc E. Merrill, assistant engineer, Public Service Commission of Washington, Olympia, Wash.; Frank A. Roell, shop superintendent, A. H. Cox & Co., Inc., South Seattle, Wash.; Frank E. Smallidge, president and manager, Electric Supply Company, Wenatchee, Wash.; D. Boyd Smith, assistant to electrical engineer, Nevada Consolidated Copper Co., McGill, Nevada; Lester J. Turley, engineer of electric power, chief engineer's department, Los Angeles Railway, Los Angeles, Cal.; Walter William Tuttle, electrical draftsman, Public Works Department, U. S. Naval Station, Pearl Harbor, T. H.; C. E. Wagner, shop foreman, Portland Railway Light & Power Company, Portland, Ore.; John C. Widrig, salesman, A. H. Cox & Co., Seattle, Wash.; Harold B. Wood, lineman, The Montana Power Company, Roundup, Montana; Vernon Radford Wright, manager, Wenatchee Battery & Motor Co., Wenatchee, Wash. Associates Re-Elected August 12, 1920 —

August Hund, research work, Berkeley, Cal.

Elections to the Illuminating Engineering Society

Two of the five new members recently elected to membership in the Illuminating Engineering Society are Western men. They are:

Robert L. Eltringham, electrical engineer, Industrial Accident Commission of the state of California, San Francisco, Cal., and John Leuthold, publisher Summit County Star, Breckenridge, Colo.

Of the fourteen Associate members elected at the same time, nine are Western men. They are:

P. A. Anderson, industrial engineer, Great Western Power Company, Oakland, Cal.; George E. Armstrong, McGraw-Hill Publishing Company, Inc., San Francisco, Cal.; Arthur F. Buss, building equipment specialist, General Electric Company, San Francisco, Cal.; Ernest M. Frelson, salesman, Edison Lamp Works, San Francisco, Cal.; Frank J. Gleiss, assistant superintendent electrical distribution, Oakland District, Oakland, Cal.; David Edward Harris, vice-president and general manager, Pacific States Electric Company, San Francisco, Cal.; Allen Higgins, Jr., salesman, Westinghouse Electric & Manufacturing Company, San Francisco, Cal.; Herbert J. Mayo, sales engineer, Benjamin Electric Manufacturing Company, San Francisco, Cal., and W. L. Stockwell, manager, J. C. English Company of California, San Francisco, Cal.

The two transfers to Member grade are:

Romaine W. Myers, consulting electrical and illuminating engineer, Oakland, Cal., and Robert S. Prussia, district illuminating engineer, Westinghouse Lamp Company, San Francisco, Cal.

The two Associate Members elected subject to the approval of the Board of Examiners are:

H. B. Blandon, manager lighting division, Alexander & Lavenson Electric Supply Company, San Francisco, Cal., and S. P. Russell, vice-president H. B. Squires Company, San Francisco, Cal.

H. C. Hoover Urges Engineer Activity in Community Affairs

During Herbert C. Hoover's recent visit in Portland, Ore., he spoke to a representative gathering of engineers of all branches on the importance and necessity of establishing a department of Public Works in the federal government.

He urged engineers to take a more active part in the social, civic and economic affairs of their communities and of the country, and stated that a speedy and successful solution of the economic situation that confronts the country could only be brought about by the cooperation of the engineer with his quantitative aspect of mind.

50,309,000 sq. mi. is the area of the Pacific Ocean. This area is destined to be the scene of the great developments in commerce and in the progress of civilization within the coming century.

HELP THE PAN-PACIFIC EMPIRE
PUT IT OVER

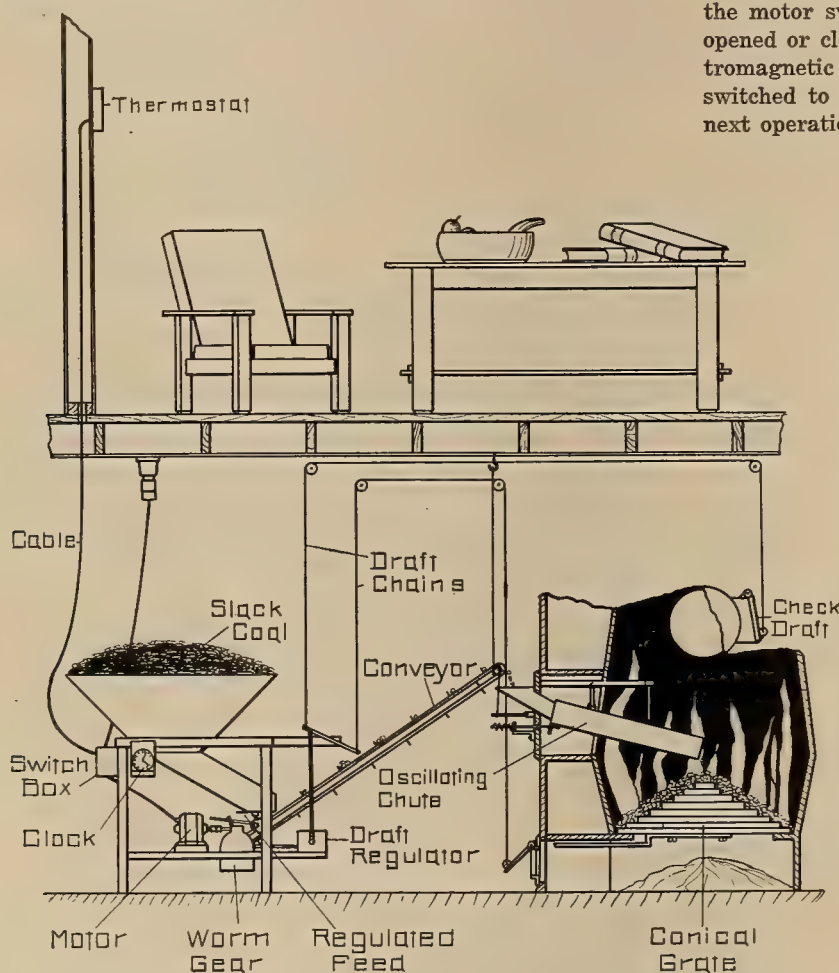
LATEST IN EVERYTHING ELECTRICAL

(Everyone from the small boy to the engineer is interested in a convenience device for the home such as the electrically-operated stoker presented on these pages. Another device described is one which will improve lighting service in small steam plants, on steam shovels, oil well derricks and locomotives. Booklets on the California Hydro-Electric Securities, The Airplane Propeller and Hydro-Electric Power in the Niagara District are among the reviews of books and bulletins.—The Editor.)

AUTOMATIC STOKER FOR HOUSEHOLD USE

An electrically-operated automatic stoker has been perfected and is now being placed on the market by the Domestic Stoker & Manufacturing Company, Salt Lake City, Utah.

The object of the device is to provide a simple and reliable stoker for household use that will fire a furnace scientifically and eliminate a considerable portion of the smoke usually produced.



The coal bill can be greatly reduced and the regulation furnace dirt done away with by this new electrically-operated automatic stoker.

The device is operated by a small electric motor which is also used to operate the draft and circuit changing mechanism. A hopper containing two hundred and fifty pounds of slack coal feeds a chute from which an adjustable slide delivers the fuel to a conveyor. The latter carries the fuel to an oscillating chute projecting into the furnace, whence it is dropped on the center of a conical grate.

The thermostat, which might be called the brains of the device, is situated in the living room and is directly responsive to change in temperature. Its range of temperature between the upper and lower limits is about one-half degree. When either limit is reached an electric circuit is closed which actuates an electromagnetic switch and closes the motor cir-

cuit. If this limit is the lower one the motor causes the damper to open and the check draft to close. At the same time a motor switch is closed which causes the motor to continue to operate and drive the stoker. The fuel being fed to the furnace rapidly takes fire and the temperature rises to the upper limit. When the thermostat reaches this limit the electromagnetic switch is again closed, the check draft is opened, and the damper is closed. Also by the same operation the motor switch is opened. Whenever the motor switch is opened or closed the thermostatic circuit is broken, the electromagnetic switch opened, and the thermostat connection switched to the other temperature limit preparatory to the next operation.

TURBINE GENERATOR UNITS FOR LOCOMOTIVE HEADLIGHTS

Although developed especially for supplying energy for locomotive headlights, the turbine-generator units just placed upon the market by the Westinghouse Electric & Manufacturing Company may be used for lighting service in small isolated steam plants such as pumping stations, small steam shovels, oil well derricks and in other applications where a small amount of lighting is required. The construction is especially advantageous for portable application, as it is designed for severe outdoor service.

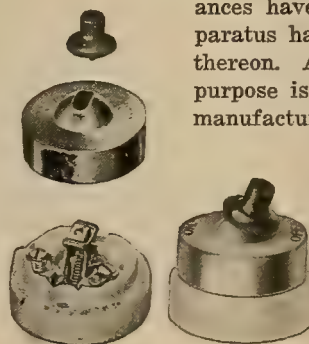
This unit is light and compact, requiring no foundations. It can be set up on a floor, heavy board or in any horizontal place and held in position with four small bolts, studs or lag screws.

While totally enclosed all parts are readily accessible by removing the end cover on the generator and the turbine end casing on the steam end. There are only five moving parts—the shaft carrying the generator armature and the turbine rotor, two governor weights, governor spindle and governor steam valve stem, thus making for simplicity of operation.

The generator end consists of one casting containing one bearing and the field poles with windings.

NEW TOGGLE SWITCH

Users of household electrical appliances have exhibited a preference for apparatus having an electric switch mounted thereon. A most convenient device for this purpose is the new toggle-switch which is manufactured by the Bryant Electric Company, of Bridgeport, Conn. The base is of porcelain in which the mechanism is fastened and sealed in accordance with Underwriters' specifications, to prevent loosening. The device is catalogued as number 2902.



Colored Lights For the Show Window

Many different makeshift schemes have been used to produce the desired color effects in display windows. In some cases gelatin has been applied and harnessed to the reflector by various methods. Incandescent lamps have been colored with various kinds of "lamp dip," but this has proved unsatisfactory because the heat of the lamp rapidly fades out the color. The use of natural colored glass lamps of the Mazda "C" type has also proved unsatisfactory.

The engineering department of the National X-Ray Reflector Company has developed a means of producing colored light in show windows which seems to have solved the problem of color effects.

The device which they present will be called by the trade name "Color-Ray" and consists of a metal frame which fits over the mouth of the X-Ray Jove and Jupiter Reflectors. This frame supports a slide of colored gelatin which is held in place by fine steel meshes. The slide slips in the frame so that the color can be changed readily. When the ordinary white light is desired the slides may be left out altogether, being very inconspicuous and in no way interfering with the amount of light that is produced.

The frame is fastened to the X-ray reflector by means of an asbestos cord harness designed so that it may be attached without disturbing either the reflector or the lamp.

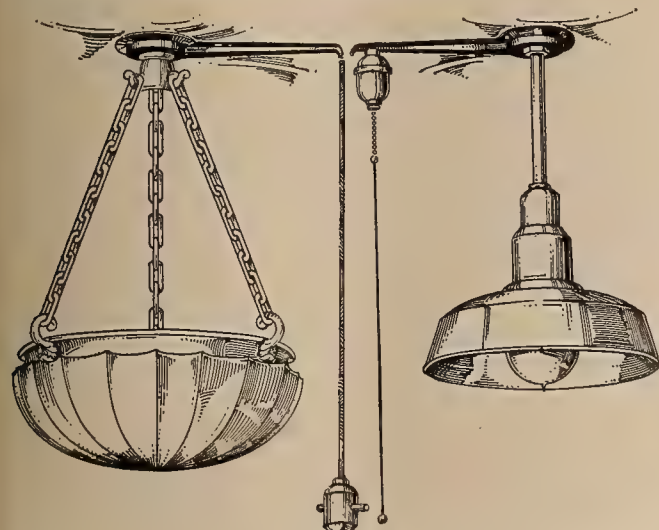
A CONVENIENT SWITCH EXTENSION

The St. Louis Brass Manufacturing Company announces a new product which they will put on the market under the name of the Brasco Switch Extensions as soon as the patents are granted. This is a small arm-like case which extends along the ceiling carrying the wire to the point from which it is attached either to a pendent or pull switch.

These switch extensions are made of steel, are zinc-plated and have a rust-proof finish. In furnishing large buildings they are especially valuable in that they save wiring for wall switches and are less costly and more satisfactory than knob work on concrete ceilings.



The new "Color-Ray" unit for use in window display lighting which was presented for the first time at the recent convention of the International Association of Display Men.



As shown in the sketch above, either the pendent or pull switch can be neatly attached to any type of fixture of the new Brasco Switch Extension.

Books and Bulletins

California Hydro-Electric Securities

In order to increase the market for California hydro-electric securities throughout the United States, the Los Angeles office of Blyth, Witter & Company has published a booklet which sets forth in a most convincing and attractive way, that data which will bring about the investment of \$700,000,000 in the electrical industry of that state within the next ten years.

This most readable material is divided into four chapters which appear under the following headings: Hydro-electric power is essential to the growth and prosperity of California; The history of hydroelectric development in California is inextricably interwoven with the state's industrial development; California's hydroelectric companies present attractive investment-field and Blyth, Witter & Company hold an enviable position in the financial domain of hydro-electric development.

The Air Propeller

Those who want a practical working knowledge of the characteristics of the air propeller and a general knowledge of its theory will welcome the book by Frederick Bedell, which has recently been published by D. Van Nostrand Company under the name of "The Air Propeller."

The author, who is professor of physics at Cornell University and a well known writer of technical books, is now preparing a book, "The Airplane," and the material in "The Air Propeller" is to be revised and included in this larger book. A brief discussion of the airplane engine and the power available for airplane propulsion is also included.

Hydroelectric Power in the Niagara District

The Hydro-Electric Power Commission of Ontario has published a thirty-page booklet which tells in an interesting manner the story of the development of hydroelectric power in the province of Ontario, Canada. Sketches and photographs show how power is generated at Niagara Falls and how this power is used in agriculture and industry.

An idea of the significance of the development of this district to the electrical industry is gained by considering that the province contains a supply of water power aggregating in all 6,000,000 horsepower, of which approximately 800,000 horsepower has already been developed.

Battery Charging Equipment

The latest equipment for the charging electric street vehicles, industrial trucks and battery locomotives is described in Publication 830 of the Cutler-Hammer Manufacturing Company. An introduction reviews briefly the different methods of charging and the various kinds of equipment, with a view of aiding the reader in selecting the type of equipment best suited to the particular conditions with which he has to deal.

In the main part of the booklet, C-H charging equipment is described in detail with illustrations and descriptions.

1,000,350,000 good words for the West have been published by the Journal of Electricity since it was founded thirty-four years ago. It is working for the best interests of the electrical industry in the region west of the Rocky Mountains and in the great countries bordering the Pacific Ocean.

HELP THE JOURNAL OF ELECTRICITY
PUT IT OVER

NEW ELECTRICAL DEVELOPMENTS

(Plans for the development of the upper falls of the Spokane River and an account of charges that a city is monopolizing the electrical supply business are important among Northwest items. The Pacific Central and Southwest districts report the construction of a number of power plants and news of the construction of several large industrial plants comes from the Inter-mountain district.—The Editor.)

THE PACIFIC NORTHWEST

BURNS, ORE.—Plans and estimates have been furnished for a municipal lighting system, estimated to cost \$53,127.

THE DALLES, ORE.—A contract has been let for the installation of 72 ornamental lighting posts to be installed in the business section of the city. Pressed steel posts with 300-watt lights will be used.

BURNS, ORE.—The city council has received from Engineer I. C. Kelsey estimates for the installation of the proposed municipal light and water plant. Engineer Kelsey estimates the cost at \$300,000.

SALEM, ORE.—The Nevada-California-Oregon Telephone & Telegraph Company, with headquarters at Susanville, Cal., has filed application with the Oregon Public Service Commission to establish a telephone exchange at Lakeview, Ore.

ASTORIA, ORE.—The Pacific Power & Light Company, with headquarters in Portland, has filed application with the Oregon Public Service Commission for permission to increase fares on its traction lines in Astoria from 5 to 7 cents.

CENTRALIA, WASH.—The Sherman County Power & Light Company has begun operation of its new 1250-kw. Curtis steam turbine, which will supply service to the city of Centralia. The company also contemplates the operation of a line to Chehalis, Wash.

FREEWATER, ORE.—The Peacock Mill Company has applied to the state engineer for permit to construct a power plant in Umatilla county. The plant is to be built in units and completed within four years. Construction contemplated includes a pipe line 1.5 inches long, concrete weir for diversion, and 54-inch wood pipe conveying water to turbine. The first unit will cost \$140,000.

ILWACO, WASH.—According to recent reports, this town is considering the purchase of the distribution system of the North Shore Light & Power Company and the installation of a 1,000-kilowatt generating plant. This will, it is believed, solve the light and power question for some time to come. At present negotiations are under way with E. E. Wood, manager of the utility company, and if they are culminated satisfactorily the lines will be taken over as soon as possible.

SEATTLE, WASH.—Seattle city officials have been advised by the state hydraulic engineer at Olympia that the city has been granted permits to appropriate waters required in the development of the Skagit River municipal hydroelectric power site. This completes the last of the state and federal permits required for the Gorge Creek project, and the Rub Creek development. These permits cover the proposed \$25,000,000 Ruby Creek dam and plant construction, the \$10,000,000 Gorge dam and plant, 1,000,000 acre-feet of water storage in the channel of the Skagit river, and the construction of a power plant on New-halem Creek to generate power needed in prosecuting the main work.

SPOKANE, WASH.—The development of the upper falls of the Spokane River at Spokane, with a potential horsepower estimated between 10,000 and 15,000 hp., is under consideration by the Washington Water Power Company, President D. L. Huntington has announced. "The next two or three months should suffice to make our plans fairly definite regarding other devel-

opments which we find enlarged power demands require us to make," said Mr. Huntington. "All of them are widely different in type. The upper falls development is the only one in consideration in the city, the others being outside the city limits. The increase in the growth of the power business has been steady and consistent and means that wise foresight should be exercised to add facilities for supplying the demand."

TACOMA, WASH.—According to a statement of Llewellyn Evans, superintendent of light, the limit of the capacity of the La Grande power plant of the city, against which the light department gave warning several years ago and toward the relief of which the acquisition of the Lake Cushman power site is aimed, has actually made its appearance. The winter demand for current, coming on top of the increase in the load which the industrial growth of Tacoma has caused during the last year, has now run the city past its capacity of production, he states. Recently, the city began buying power from the Tacoma Railway & Power Company during the peak hours of the days, although its four generators at La Grande were working even beyond their rightful capacity. The Lake Cushman power is needed immediately, but cannot be counted upon for probably two years. Condemnation hearing in Mason county is set for November 20.

TACOMA, WASH.—Injunction proceedings, charging the city of Tacoma with exercising a monopoly on the electrical supply business, have been filed against the city and Ira S. Davisson, as commissioner of the light department, by A. Z. Smith, R. A. Wheelock and Roy F. Owen, three local dealers in electrical apparatus. Seven alleged unfair practices are cited by the complainants, which they declare they have undertaken for themselves and all other persons and corporations in the city similarly situated. Numerous unlawful and unreasonable methods employed by the city in handling electrical apparatus, they say, has lost them large sums of money, and has resulted in their oppression as taxpayers, license payers and business men. The complaint alleges that the city sells electrical apparatus and appliances at 5 per cent above cost; that motors are leased by the city or an agreement made with the party that he can buy the motor and get credit for any amount of rent paid up until 12 months, less the interest on the investment; that the city has secured contracts with one or more large manufacturers for the exclusive handling and sale of their motors; violation of the city charter because of the alleged habit of the commissioner of purchasing electrical goods without calling for bids, where supplies exceed \$500 in cost; that the city carried on a general business with all comers, whether in or out of the city; that the city makes bids unlawfully in competition with all dealers, when bids are called for; that it is the city's practice of keeping leased motors in repair, the cost for this being absorbed by the city out of its treasury. For all these items, the plaintiffs ask the court to restrain the city from continuing such practices. In a second and separate cause of action brought by the three dealers, they declare that an early shortage of power threatens the residents of the city through Commissioner Davisson's practice of selling power. At the cost of \$2,000,000, the city built

a hydroelectric generating plant, they declare, with ample capacity to supply the city with light and heat for many years to come. Of late, they say, Commissioner Davisson has exceeded his powers and sold current to many persons and corporations outside the city, so that the amount of power is greatly reduced. Such sale of power, it is alleged, has been made at rates below those charged to the citizens of Tacoma.

THE PACIFIC CENTRAL DISTRICT

BAKERSFIELD, CAL.—Plans are being made to install a large concrete dam in Tejon Pass canyon, to impound water for reclaiming Tejon ranch acreage.

FRESNO, CAL.—Work was started about the middle of October on the San Joaquin Light & Power Corporation's new \$50,000 substation to supply the towns of San Joaquin and Tranquility in Fresno county. Three 1500-kw. transformers will be installed. Estimated cost of the 60,000-kv. line, 24 miles long is \$86,000, while the cost of the distribution line is estimated at \$125,000.

SACRAMENTO, CAL.—The United States Electric Steel Production Company of San Francisco contemplates the construction of a \$5,000,000 plant in Sacramento, according to a letter addressed to the City Commission. The proposed plant would develop 100,000 hydroelectric horsepower, according to the plans. The company is asking for a free site in the city. The letter has been referred to the Chamber of Commerce.

SAN FRANCISCO, CAL.—It having been held by the State Supreme Court that a municipal corporation in the operation of its utilities, either within its own limits or in outside territory is not under the control of the Railroad Commission, the Commission has ordered the dismissal of the complaint filed by the Southern Sierras Power Company against the City of Los Angeles. The complaint involved service extension.

MARYSVILLE, CAL.—Resumption of gold-dredging along normal lines is announced from the Yuba river and Oroville fields, following lifting of the ban against the use of electric power. Practically all the companies have been operating part time since early summer because of shortage of power, and several dredges were closed down. Near Hammonton the Yuba Consolidated Goldfields has eight monster dredges in commission.

STOCKTON, CAL.—Involving a \$2,000,000 power plant project, application for storage and use of part of the natural flow of the north fork of the Stanislaus river has been filed with the recorder of Tuolumne county. Frank B. Pattee of Oakdale and Samuel Bernhard of San Francisco have applied for the water rights in contemplation of the erection of the large power plant near the headwaters of the river to develop about 9,600 horsepower.

OAKLAND, CAL.—Estimates of the costs of three different projects proposed at the Seventh street crossing are being made by Harbor Engineer K. S. Heck, in preparation for the reopened Railroad Commission hearing. Heck will investigate the possibility of an extension of the Sixteenth street trestle for 1,000 feet toward Seventh street; a highway incline over the Southern Pacific tracks and a subway under the

tracks. His estimates of costs will be submitted to Commissioner Frederick Soderberg.

OAKDALE, CAL.—The Pacific Gas & Electric Company has a force of men at work on construction of the Spring Gap power house, the first unit in a program which calls for the expenditure of \$4,000,000 or \$5,000,000 in reservoir and other work along the Stanislaus river. Tuolumne county is opposing the construction of this power house because of the fear that it may cause a loss of water by diversion of the stream of the south fork of the Stanislaus to the middle fork. However, this will make it possible to use the water for a second time for power, and will give the company more water to sell to the Oakdale and South San Joaquin irrigation districts for irrigation. The Water Commission now has the matter up for adjudication, and is expected to shortly give a decision.

FRESNO, CAL.—The new Midway steam plant of the San Joaquin Light & Power Corporation, the camp for which was established at Button Willow, Kern county, is well under way. One 12,500 kva. unit with transformers, etc., is due on the ground in December or January and it is expected to operate the plant by June. The ultimate development of the plant is four 12,500 kva. units, the generating and transforming equipment of which is of General Electric manufacture and the switching equipment Westinghouse. The plant is located practically in the Elk Hills oil district where the Standard Oil Company has in the last few months brought in several large new gas wells. The boilers will be equipped entirely with gas furnaces which can be turned over with little difficulty to oil burning fuel if the supply of natural gas should fail.

SACRAMENTO, CAL.—Following the completion of a \$2,000,000 irrigation system and the building of the Southern Pacific Railroad through the property, it is announced that the Sutter basin project in the Sacramento valley is to be colonized. This property, comprising upward of 45,000 acres, has been under cultivation for three years and this season produced 2,000 carloads of grain and vegetables. Sutter basin lies at the confluence of the Sacramento and Feather rivers, twenty-three miles northwest of Sacramento. It is the last great body of an alluvial soil in the Sacramento valley to be developed and prepared for settlement. Unlike most bottom land development projects, the Sutter basin has a complete irrigation system with a pumping plant at Tisdale capable of throwing 1,380 acre-feet of water daily and two other smaller plants.

HANFORD, CAL.—That natural gas will be used in the cities and towns of Kings county seems highly probable now that the sale of a franchise for such a purpose has been ordered by the supervisors at the instance of Mayor F. A. Cleveland, of Corcoran. The Tulare lake gas wells near Corcoran have been reported producing large quantities of gas and this action is considered but the recognition of the possibility of organizing such a distributive company.

SONORA, CAL.—Application has been made for 130 cubic feet per second or 5,200 miners' inches of water from the north fork of the Stanislaus river for a two million dollar electric power proposition to be known as the Ramsey Project, which will develop 9,600 horsepower. The point of diversion is in the counties of Tuolumne and Calaveras on the north fork of the Stanislaus river, above the junction of Rattlesnake Creek. The canal and pipe line is to be 11¼ miles in length, terminating near the South Grove of Big Trees. The dam will be 225 ft. high, 1,040 ft. long on the top and 30 ft. long on the bottom; width of top, 10 ft. The dam will be of rock-fill construction with concrete face reinforced. Construction work will begin in two years and be finished within five years. There will be a fall of 924 feet to power in the river.

THE PACIFIC SOUTHWEST

JEROME, ARIZ.—Construction of the impounding dam at Box Canyon, nine miles below Camp Verde, may be under way as early as January.

SANTA BARBARA, CAL.—Plans are under way for the construction of the dam on the Mono, at a cost of \$1,500,000, for Montezito water supply.

CORONA, CAL.—Extension of the Pacific Electric line is contemplated to connect up the line between Corona and Stern, a distance of about 12 miles.

CASA GRANDE, ARIZ.—Mark A. Smith recommends that a bond issue for \$300,000 is the only feasible means of building the San Carlos dam, to be issued by the Government and the proceeds placed in the reclamation fund.

GARDEN GROVE, CAL.—A special bond election was held October 25 for the purpose of voting on a bond issue for \$100,000, for the purpose of constructing necessary conduits, drains, etc., for draining lands and acquiring necessary property.

LOS ANGELES, CAL.—Sealed bids will be received by the Board of Supervisors, up to 11 a.m. Nov. 8, for furnishing all labor and material necessary for the erection of timber concrete lined pipe duct and accessories at the County Farm in accordance with plans and specifications on file in the office of the Board of Supervisors.

TUCSON, ARIZ.—Fire of unknown origin has destroyed the gas plant of the Tucson Gas, Electric Light and Power Company, causing a loss estimated at about \$50,000, which is fully covered by insurance, it was stated. The fire, which was said to have originated in the generating room of the plant, spread quickly throughout the establishment owing to the inflammable material of which the building was constructed.

LOS ANGELES, CAL.—A resolution commending the Southern California Edison Company for initiating a \$200,000,000 project to furnish adequate electrical power to Southern California and urging the Railroad Commission to grant a rate increase to the company was adopted at a meeting of the board of directors of the Los Angeles County Farm Bureau recently. The resolution states that the project can become a reality if the increase in rates is granted.

REDLANDS, CAL.—The Southern Sierras Company is planning on building at least one and probably two big power houses in Mill Creek Canyon. The company has heretofore operated power houses in Inyo county alone. The plan is for a big power house just above the Edison intake in the Mill Creek; in fact, the spillway from the Southern Sierras house would empty into Edison intake. The other power house will be farther up the canyon so that the first power house will get the necessary fall. The Mill Creek plants will be operated almost entirely as reserve plants. They will generate 2500 horsepower.

SANTA FE, NEW MEX.—The first official step toward building an interurban electric railway north from Albuquerque was taken recently when the City Electric Railway Company, incorporated under the laws of Arizona, filed a foreign corporation's statement in the Corporation Commission's offices. The filing of the statement permits the company to do business in New Mexico. The City Electric's purpose, according to a statement, is the building and operation of trolley lines and it was said unofficially that the company's first project would be the construction of a line north from Albuquerque along the Albuquerque-Alameda road. The project has been under consideration for some time, but until today no official indication of intention to carry out the plan was given. The City Electric of Arizona, although it has the same name as the company which operates the local system in the Duke City, is an inde-

pendent company capitalized at \$150,000, of which \$20,000 has been issued.

THE INTER-MOUNTAIN DISTRICT

SALT LAKE CITY, UTAH.—Permission has been granted to the Utah Power & Light Company by the Public Utilities Commission of Utah to extend its lines to Millville, and in Juab county.

BRIGHAM CITY, UTAH.—Brigham City has sold its \$200,000 electric light bonds to the Hanchett Bond Company of Chicago for \$192,500. This action was taken by the city council at an adjourned meeting held October 16.

LAVINA, MONT.—It is reported that the Town Council is making plans to install a municipal lighting system. Certain preliminary steps have been taken and C. A. Renshow, engineer of Roundup, Mont., has been engaged to supervise the work. Bids have been called for. It has been decided to use wooden poles for the mounting of the lights.

SALT LAKE CITY, UTAH.—The new plant of the Uintah Power & Light Company, fifteen miles northwest of Roosevelt, on the Uintah river, is now ready for operation. This plant will supply power to Duchesne, Roosevelt, Myton and other towns in that vicinity.

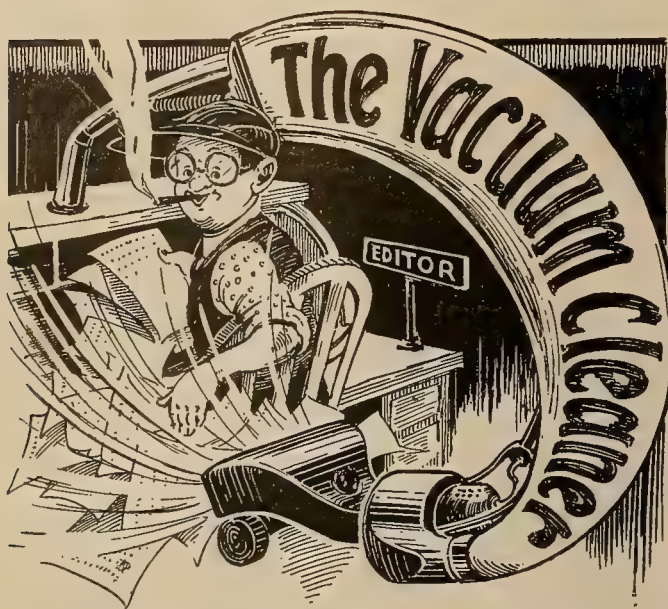
DENVER, COLO.—Ground will be broken in 90 days for the plant of the Howard Pulp & Paper Company, a newly organized corporation for the manufacture and sale of news-print paper on a large scale. The mill will be erected at Idaho Falls, Idaho, in absolutely virgin territory and in an area which is ideal for timber, logging and milling of the product.

OGDEN, UTAH.—Construction work has begun upon the new ice plant to be erected in the railroad district by the Pacific Fruit Company. This plant will be electrically operated, the initial load being about 1500 horsepower. The plant, it is said, will be the largest ice plant in the West, having a daily output capacity of 250 tons and a storage capacity of 20,000 tons. It is expected that the plant will be completed by July 1 of next year.

MISSOULA, MONT.—Through the efforts of James Harbert, recently elected one of the vice-presidents of the Northwest Reclamation League, facts and figures of vital interest to residents of western Montana were obtained by him from the committee of the Columbia Basin Survey commission, regarding one of their projects, the erection of a dam at Big Rock, located one and three-quarters miles below Polson, which will be known when completed as the Big Rock dam.

SALT LAKE CITY, UTAH.—Utah Granite & Marble Company has filed application with the state engineer for the use of ten' second-feet of water from Little Cottonwood Creek, in Salt Lake county, to develop 270 horsepower. A wood or concrete dam is planned in the river, from which the water would be conducted by an earth channel, a wooden flume and an iron pipe 36 in. in diameter, falling over a 48-inch Pelton wheel under a head of 300 ft. The site named for the diversion works is about three miles east and twelve miles south of the business district of Salt Lake City.

POCATELLO, IDA.—A project which comprises the canalization of the lower Snake River for the purpose of making a deep water inlet from tidewater to Lewiston, Idaho, was discussed at a recent meeting held at Lewiston by the United States board of engineers with local people interested in the proposition. The project, which has been officially surveyed by federal engineers, comprises locks and ten dams along the Snake River between Lewiston and Riparian, Wash. The possibility of establishing large power plants at the dams, for the purpose of supplying electric current to the manufacturing industries which are developing in that section, is one of the principal considerations in connection with this project.



The enterprising mind, which is not afraid to strike out in a new direction, has always been an object of admiration. But what about this:

"An inquirer desires to purchase machinery and supplies for a small tannery, and also a book of information regarding the operation and manufacture of a tannery."

We suggest that for the benefit of enterprising beginners all businesses selling out should throw in a book of directions. Thus:

"For Sale—Small hydroelectric system, complete with book of information regarding power-plant operation and maintenance. A child can use it."

* * *

A few advertisements that we are not planning to run in the Searchlight Section are as follows:

Wanted—a female donkey. Apply personally.

Wanted—Movie theatre piano player; no experience necessary.

Wanted—Housekeeper, for a man and two middle-aged children.

Wanted—Respectable sales girls. No flirts need apply. We'll teach you.

* * *

In spare moments—that is after we have read the colyums and the comic sections—we study the market reports, and "view with alarm" the constant abusive publicity which is given to the gentle and harmless egg.

"Eggs strong," says one headline. Well, any eggs are if you keep them long enough. "Best Eggs Off," says another, leading the public to wonder what the lower grade of eggs must be like. "China Eggs Crash" sounds like a needless remark. Why throw them around? An article headed "Eggs Fall with Butter" is, we presume, the biography of an omelette. But the point is that whatever happens to eggs the paper always makes the worst of it.

* * *

Still another contribution to our volume of Useless Statistics affirms that if all the stamps issued by the government during the past fiscal year were collected and laid end to end, they would form a chain 18,000 miles long, about equal to the distance from New York to the Philippines. The writer goes on to say that the number was 10,061,439,768, representing a face value of \$180,957,385. Of the whole number 5,130,249,018 were two cent stamps and 3,798,961,039 were one cent. But one thirty-cent stamp was issued.

Will anyone confess to that thirty-cent stamp?

Originality in business cards is being advocated by a writer on salesmanship. He says:

For example, one of the best business cards in the world is a recent magazine opened to your firm's advertisement.

Another highly practical form of business card is the article you are selling. When the prospect holds out his hand for your card, hand him a sample of the device you are peddling—or a picture of it, or a substantial facsimile of a testimonial letter.

The conventional business card is like a conventionalized selling talk. It is correct, but it lacks effectiveness and spontaneity of an original and unexpected approach.

That may be all right if the prospect comes out and gets your card himself, but would you send the office boy in with a copy of the telephone directory or the Saturday Evening Post on a silver tray? And besides, your business cards are very seldom returned to you, and carrying an adequate supply of this kind you might be mistaken for a book agent. The other idea also has its good points, but personally we should be rather disconcerted if we held out our hand to a salesman for his card and he handed us a washing machine, or a picture of an electric range.

* * *

Art in business seems to be going a little far. A recent advertisement reads:

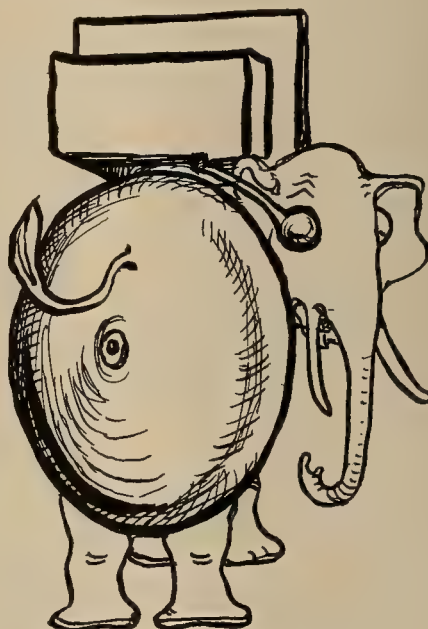
"Firm of manufacturing silversmiths, consisting of artistic novelties, desires to find a market here for its goods."

Now a silversmith who is an "artistic novelty" must be worth seeing, but a whole firm consisting entirely of artistic novelties ought to go into the circus business.

* * *

"Large scale production" is an integral part of the modern industrial system, but it seems that some people have been abusing the meaning of the term. A negro in Memphis needed a new pair of overalls, and a Scranton, Pennsylvania, factory got the order. The garment used up 25 yards of material. It has a girth of 106 inches and each hip pocket will hold a watermelon. The owner is nine feet, four inches tall, and weighs 540 pounds.

* * *



ELECTRICAL HYBRIDS — I.

The Electric Bellephant

The Bellephant is very shy;
He lives up near the ceiling,
And any caller at the door
Is sure to start him squealing.

IN THIS ISSUE: Building the Agricultural Load in the West

JOURNAL OF ELECTRICITY

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Vol. 45, No. 10

SAN FRANCISCO, NOVEMBER 15, 1920

Per Copy, 25 Cents



The new
Thor
No 32

Progress has always been the dominant idea of the Hurley organization. The New Thor No. 32 now in production reflects how successfully this idea has been developed.

This washer is the result of fourteen years of effort in the design and development of a machine that would appeal to the most critical judgment of jobber, dealer and user. It is more than an improved Thor — it is a wonderful achievement.

The New Thor No. 32 is a washer that will have a tremendous influence on the appliance opportunity in every community.

HURLEY MACHINE CO.

New York

CHICAGO

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Exclusive Distributors for the Pacific Coast:

Pacific States Electric Company

San Francisco

Oakland

Los Angeles

Portland

Seattle



"Federal Electric" 20 Years of Integrity

Supplies—

National Renewable Fuses
Federal Bushings, etc.
Hubbell Receptacles, etc.
G. I. Mazda Lamps
V. V. Fittings
Steel City Outlet Boxes
Matthews' Lamp Guards
Connecticut Cutouts, etc.
Chelton Switches
Duraduct Flexible Conduit
Reliance Time Clocks
Westinghouse Tape
Rubber Covered Wire
Rigid Conduit

Appliances—

Federal Washing Machines
Federal Vacuum Cleaners
Heating Devices
Westinghouse Fans
Federal Lanterns
Dumore Motor Devices

Electric Signs—

Federal Signs—9 styles
Federal Roof Displays
Federal Interior Signs
Reco Flashers and Hoods
Thordarson Sign Transformers

Electric Sirens—

Federal City Fire Siren
Federal Industrial Siren

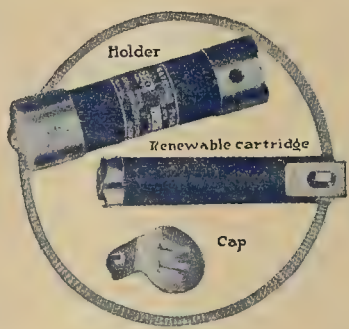
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Hubbell Shades
X-Ray Projectors and Shades

APPROVED by the National Board of Fire Underwriters—by the Mutual Fire Prevention Bureau—and the only renewable fuse approved by the Assoc. Factory Mutual Fire Insurance Cos.

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JOURNAL OF ELECTRICITY

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VOLUME 45

SAN FRANCISCO, NOVEMBER 15, 1920

NUMBER 10

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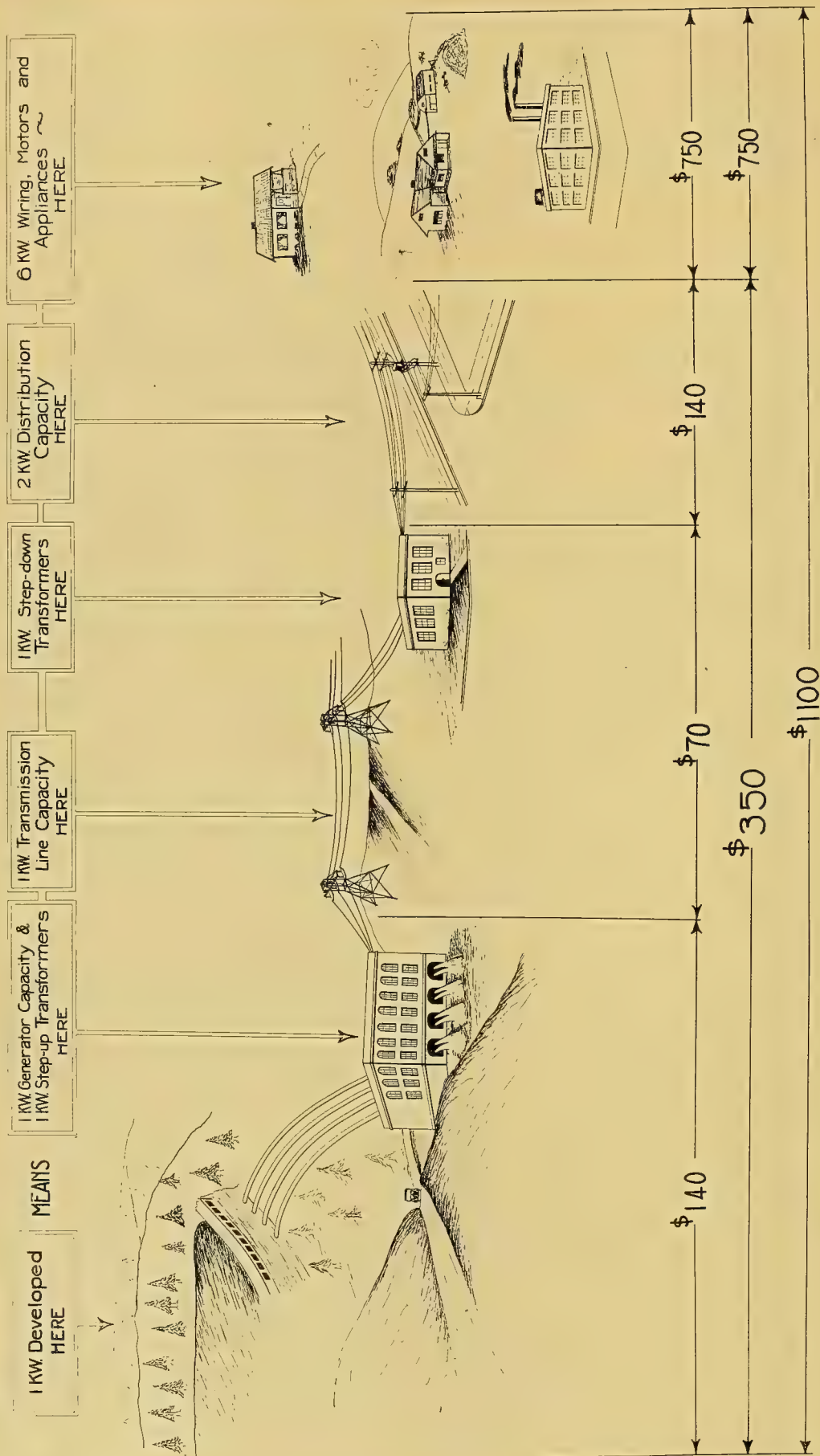
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THE ELECTRICAL TRIO:

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ELECTRICAL WORLD — JOURNAL OF ELECTRICITY — ELECTRICAL MERCHANDISING



WHEN THE DOLLAR STARTS ROLLING IN PUTTING KILOWATTS UPON THE LINE

Here is a wonderful pictorial representation of what happens within the electrical industry for every kilowatt of energy developed from our waterfalls in the West. In agriculture, in industry and in the home, the additional sums of money involved over and above the electrical investment, must represent many times this vast array of figures. The estimated present program of power development on the Pacific Coast is approximately 140,000 kw in new generator capacity per year, or \$19,600,000 in transmission equipment, \$9,800,000 in transmission capacity, \$19,600,000 in distribution installation, and \$105,000,000 per year in wiring (including labor), motors, lamps and appliances. ¶ This chart was prepared by John M. Morris of the Westinghouse Electric & Mfg. Company, Los Angeles, by means of data furnished through the Southern California Edison Company and the Journal of Electricity.



JOURNAL OF ELECTRICITY



DEVOTED TO THE UPBUILDING OF THE ELECTRICAL INDUSTRY IN THE WEST
AND IN THE COUNTRIES BORDERING THE GREAT PACIFIC

Volume 45

SAN FRANCISCO, NOVEMBER 15, 1920

Number 10

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Western Thanksgiving...

*For west winds chill with the sunset tide,
For trees on a bronzing slope,
For the fresh, moist soil of the country side,
For the heart's unending hope;
For the feel in the hand of a goodly task,
For adventure unexplored,
For the will to seek and the faith to ask—
We render thanks, oh Lord.*

*For blessed silences of night
Once hideous with sound,
For green things stretching toward the light
Where blood once stained the ground;
For clean hands and the call to build
Onward constructively,
For all the future, unfulfilled—
We render thanks to Thee.*

*For hearts unbowed with a world's despair,
Searching anew for the treasure;
For the clear, clean thoughts of the young who dare
To build to a newer measure;
For the West with its youth and its wide frontier,
And its challenge to keener living;
For its call to the strength of the pioneer—
We offer our thanksgiving.*

—C. G.

It is only fitting that in this issue of the Journal of Electricity, which is devoted to the uses of electricity on the farm, some mention be made of one of the many vast projects which are now being considered in the West. The map which accompanies this issue shows the scheme which Col. Robert B. Marshall, for a number of years chief geographer of the United States Geological Survey, has presented to the people of California to convert the great interior valley of California, composed of the Sacramento and San Joaquin valleys, into one big irrigation project.

Such projects as these are necessary for the development of the West, and in justice to the great mind which conceived this plan of diverting rivers from their channels and putting them to useful work, an investigation of the feasibility of the plan should be made. A committee should be appointed by the state, to consist of a contracting engineer, a civil engineer, a hydraulic engineer, an electrical engineer, representatives of the power companies, representatives of the irrigation districts involved, representatives of the state engineering department, the state water commission and the state railroad commission. Besides these, representative men from the banking and bond houses and various big commercial projects of the state should be consulted by the committee suggested above, to determine whether or not the project could be handled by a bond issue as proposed by Colonel Marshall. The report of such a

committee would be authoritative, and the people of California would be willing to abide by its decision.

This committee should not only investigate and report upon this project suggested by Colonel Marshall but upon all the possibilities for the development of the waters of the state, both for irrigation and hydroelectric power. The scheme to develop the great interior valley of California is but one example of the constructive thinking that is needed in the upbuilding of this great empire of the West, and all of these should be considered and carefully investigated by competent committees.

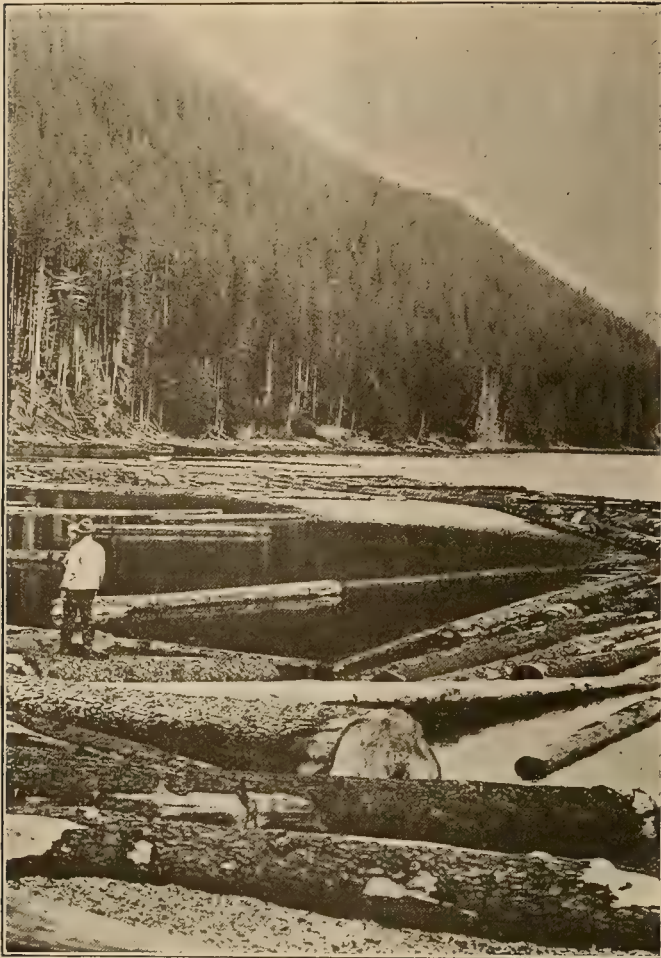
The question is not as to the possibility of such a scheme but as to the practicability of it. With the wealth of California in her soil and in her hydroelectric resources, this seems to be an opportunity to combine the two to the best advantage of the people of the state. If the plan is feasible at this time then let us proceed to carry it out with all possible dispatch, and if it is not feasible then let it stand as the vision of a man who lived before his time, and let us pass the idea along to our children as an ideal to be striven for.



DIARY OF AN OLD-FASHIONED FARMER'S WIFE

4:00 a.m. Rise and dress by candle light.

MORE ELECTRICITY NEEDED ON THE FARM



WOOD PULP POSSIBILITIES IN SOUTHEASTERN ALASKA

It is estimated that there are about one hundred million acres of forest and woodland in the territory of Alaska, of which a large proportion in the southeastern district is especially adapted for use in the making of paper pulp. An abundance of water power awaits only the industrial demand for its development. One paper company has already taken advantage of this situation to establish a pulp mill in this region and government records show that there is sufficient raw material and power at hand to supply twenty more continuously.

Perhaps the most characteristic element in the power company business of the West is the importance of the agricultural load. So outstanding is this feature of Western conditions that it will be a surprise to many people to learn that the farm demand is one of recent growth, the first educational work along these lines being carried out some eight or ten years ago by California companies. Although, of course, the special arid climate of much of the western area has had to do with the phenomenal growth of this load, nevertheless its extent may fairly be credited to the foresight and liberal policies of the power companies of this region.

In a survey made by the Journal of Electricity the results of which appear on another page of this issue, the situation in California has been analyzed as an example of what can be done in the agricultural field. The farm load in that state, which is greater than that of the entire remainder of the United States put together, is shown as the direct outcome of a development policy on the part of the companies concerned. Rates were low, the city customer rightly being allowed to bear some of the burden of a rural development which indirectly benefited him.

Extension policies were liberal. One instance is on record of a power company which built an extension line at its own expense for 148 miles across desert country in order to connect up a single farm. The entire intervening district has since fed on to that same line and amply justified the daring of this pioneer work. Today, of course, the situation is somewhat less spectacular, but Western rates still appear extremely low to those familiar with similar conditions in the middle West and Eastern states.

All this, more than anything else, serves as a testimonial to the advantages of the rural load. The skepticism of those who looked upon it as disproportionately seasonal has vanished before the records of 75 per cent and higher load factors upon California systems which serve agricultural districts. The tendency now is toward a greater development of the domestic load upon the farm, as offering a means of bettering the individual load factor and thus improving the situation beyond even its present limits. The California experience is of interest, both in its historical significance and in the details of its handling—and may well serve as an example to other regions which are developing along similar lines.

It is questionable if there has ever been a more helpful gathering among electrical supply jobbers than that which took place at Pacific Coast Jobbers' Association Del Monte during the last semi-monthly period. The occasion was the quarterly convention of the Pacific Division of the Electrical Supply Jobbers' Association.

There has long been a deep-felt need for definite statistics on what actually happens when one dollar is set rolling in investments of hydroelectric equipment, and it is interesting to see that this gathering brought out in its open session the very interesting and important fact that for each kilowatt of hydroelectric equipment installed, a total of \$1100 is put into play in the electrical industry from the time the energy is taken from its native haunts in the mountains until the time it is delivered as light or power in the busy city, the farm or the home, a hundred or so miles distant. Not only was this fact brought out, but the segregated units of investment were analyzed, showing where this \$1100 is spent.

Deeper than this, however, was the interesting and timely information given by John A. Britton, vice-president and general manager of the Pacific Gas & Electric Company, as to why the West may look for unprecedented prosperity during the next ten-year period; and by A. N. Kemp, comptroller of the Southern California Edison Company, who pointed out in a scholarly manner definite reasons why rates might well be fixed on security investment issues as suggested by the California Railroad Commission, taking into account proper rewards for efficiency that will bring returns to the public, to the utility company and to the individuals in that company when economies are introduced. These matters are presented in fuller detail in other parts of this issue, and need no further emphasis here.

Wholehearted appreciation is due to the Pacific Division of the Electrical Supply Jobbers' Association for this new and effective effort on their part to be of assistance to the industry throughout the West. It will be remembered that it is to this Association, perhaps more than to any other, that the West owes a debt of gratitude for the splendid cooperative activity that now distinguishes this section of our nation. It was ten or twelve years ago that the seeds of cooperation were sown in discussion leading toward the harmonizing of the different branches of the industry. These first seeds were sown at the sessions of this Association, and unquestionably it was in these early constructive thoughts that the splendid ideals of W. L. Goodwin, now so effectively being put into practice throughout the East, had their origin. From this source, too, must have sprung much of the helpful pre-formative discussion that made possible the organization of the California Electrical Cooperative Campaign, which was perfected during 1917 at the Riverside Convention of the Pacific Coast Division, N. E. L. A.

While it must not be said that any one branch of our industry in the West is to receive more credit than any other in the splendid working out of this cooperative ideal, still it is but right to put on record the early pioneer work of the Pacific Division of the Electrical Supply Jobbers' Association.

The present law in Washington covering the subject of construction work in hydroelectric practice should be repealed. Forceful attention was called to this law in the issue of the Journal of Electricity for October 15, 1920, under the title "Selling the Railroad Commission." The law as now in force, or as proposed to be put in force in the new year, will bring incalculable damage to the utilities of that commonwealth. The law is retroactive, necessitating extensive replacement

of power company equipment to be completed by 1922. Men and materials for this work all have to be obtained within this time, and yet a one thousand dollar fine for every offence, with each offence made accumulative, is the penalty for failure to comply. Under our present system of regulation it is the people of a community who have to pay for foolhardy laws such as this. This matter not only affects the commonwealth of Washington, but also certain other commonwealths of the West where similar laws have been attempted. Men of the industry would do well to use every opportunity possible to rescind this enactment in the state of Washington.

Over a year and a half ago, at one of the contractor-dealer meetings in the West, the manufacturers were quite severely criticised for not providing a greater margin on the sale of motors. At that time it was

brought out that unquestionably manufacturers would be glad to provide the additional margin if the facts of the case required such; it was also brought forcefully to the attention of the contractor-dealers that they themselves were the only people who could provide the manufacturers with the real facts as to their cost of doing business, and the request was made for such statistical information. To date nothing has been forthcoming. Here is statistical data that contractor-dealers can no longer afford to refrain from gathering.

A ray of light, however, is already beginning to shine, for we are reliably informed that in recent months contractor-dealers in the West have called in certified public accountants to audit their books, and it is confidently expected that at an early date, over the certified public accountant's signature, will appear the following information: First, the financial foundation of the business that has been investigated, which will include the capital invested, inven-



ONE OF THE LARGEST AGRICULTURAL LOADS IN THE WEST

The rice industry of California is a recent development which has risen from nothing to a crop of over twenty-one million dollars per year within the last five years. In spite of the power shortage of this year, the installed capacity of motors used by this industry increased from 20,629 to 29,793 hp. and the current consumption from 19,250,419 kw-hr. in 1919 to 25,135,357 kw-hr. in 1920. This was in spite of the fact that warnings of the water shortage sent out before the planting season caused a curtailment of the acreage planned. The rice industry, further, was the first to be cut down in power by the power administrator and in consequence over 10,000 kw. in gasoline engines and small steam plants were installed in the fields to supplement electric power. This is only one instance of the development possible in Western agriculture under the stimulus of electric service.

tory and other items of interest; and second, the operations of the business, including gross sales, overhead charges, profits, and the like. A summary of such statistics as this will undoubtedly give some idea as to what the true facts of costs are. If these facts demand greater margins, no manufacturer will fail to recognize the situation. If, on the other hand, the facts of the case show that the margins are already sufficient, and to get the benefits of them it is the responsibility of the contractor-dealers to practice economies and better merchandising methods, then the contractor-dealers in turn must recognize the situation.

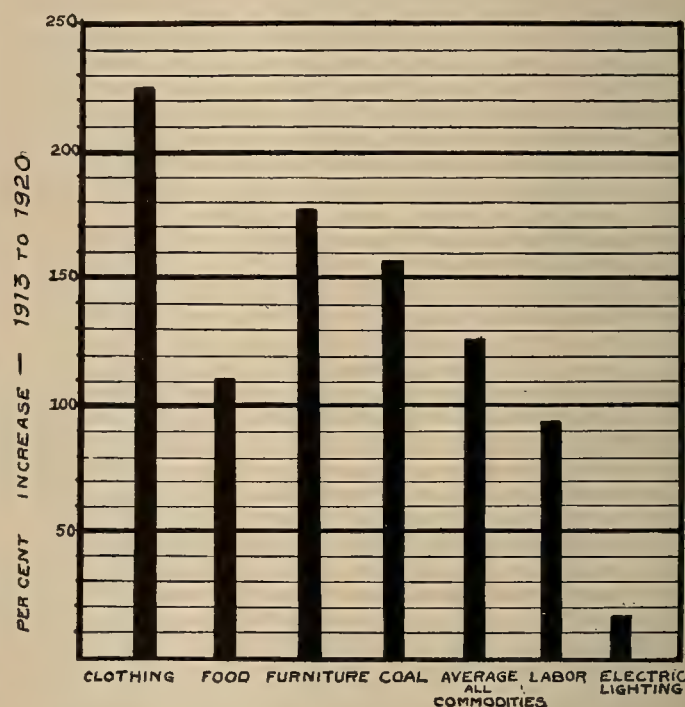
The news that Salt Lake City has been chosen as the meeting place for the 1921 Convention of the American Institute of Electrical Engineers has a special significance to the electrical industry in the West. For the first time in the history of the Institute the annual convention is to be held in a truly Western city. This fact should be borne in mind by all the local sections west of the Rocky Mountains, and they should cooperate in every possible way with the Utah Section to make this convention the best ever.

The creation of the Federal Water Power Commission has directed more than ever the attention of electrical men to hydroelectric development, and as the West contains nearly 70 per cent of the undeveloped water power and more than 27 per cent of the developed water power in the United States, it is only right that this great body of electrical engineers should choose the West as the gathering place. This convention will give a wonderful opportunity to Western engineers to show some of those records for which the West is famous and of which the West is justly proud. Let us all help the Utah Section of the A. I. E. E. in every way possible to make this convention a success, so that in the coming years a Western city will always be considered a logical meeting place for this great aggregation of engineers.

Along with the splendid progress that is being made in hydroelectric development throughout the West wherein many world records in engineering achievements are being surpassed, it is interesting to note that the telephone

coupled with radio activity is not lagging behind. Recent announcement was made, for instance, that the great radio station at Bordeaux, France, is sending out longer wave lengths than any thus far in use, this design having been perfected at Palo Alto, California. Statistics from telephone service and operation throughout the United States, particularly in the large cities, show that the two great cities of California outdistance any other cities in the nation in intensive use of the telephone, San Francisco leading all cities, not excepting New York, Chicago or Philadelphia, and Los Angeles following next behind San Francisco. But one of the most interesting phases of new develop-

ment is that consummated by the Pacific Telephone & Telegraph Company about the middle of July last whereby radio connection has been made from San Pedro, California, to Catalina Island in such a way that a citizen at San Francisco or any other city of the West served by this company desiring to telephone to Avalon on Catalina Island may do so in the ordinary way. This message is transferred automatically by wireless telephony from San Pedro over to Catalina Island and sent again on the regular telephone switch exchange. A telephone conversation said to be a world's record was carried on recently between the Avalon station and the steamer Gloucester, off Philadelphia, over 4,100 miles of wire and wireless. Such advances as this indicate the large activity and vision that pervade all branches of the electrical industry throughout the West.



ELECTRIC LIGHT RATES AND THE HIGH COST OF LIVING

Increases in utility rates were not only the last of all to be made, but they are much lower than those of other commodities, according to the Illinois Committee on Public Information. The above chart, which is compiled almost entirely from government figures, gives an idea of how little the electric utility industry has to fear from a drop in the cost of living. Unlike clothing and similar commodities, it neither benefits nor suffers from fluctuations in market conditions, except as the general prosperity and growth of the community is affected. With the optimistic prophecy for the continuing growth of the West within the next few years which is presented elsewhere on these pages, public utility companies in this district may look forward to a period of continuing expansion.

It is interesting to note that while the West for some years now has led the world in the uses of electricity on the farm, still a vast growth in agricultural uses of electricity beginning only has been made. Three years ago the Journal of Electricity, after a survey of the situation in the West concerning agricultural uses, set forth the fact that there were in California some 10,000 installations of electric motors on the farm. Since that time the growth has been phenomenal and this record has been outdistanced by three hundred per cent. The California farmer now uses more mechanical power per acre than any other farmer in the United States, a recent survey showing that

over 33,500 electric motors are now in use on California farms. According to Professor L. J. Fletcher of the Division of Agricultural Engineering of the University of California, the great power companies feeding the San Joaquin and Sacramento valleys had a connected agricultural load of 302,000 hp. as of June 30, 1920, the motors averaging between 8 and 9 hp. Phenomenal as this use seems to be, even this is but a beginning, for in the San Joaquin Valley alone, fed by one great power company, it is estimated that while but about 245,000 acres are today included in the agricultural pumping load, some 3,000,000 acres still await development.

This growth is typical of conditions throughout the West—of the great district along the Columbia River in Washington and Oregon, of the fertile valleys of Montana, and of the inter-mountain regions surrounding Salt Lake City.

When Moses came down from Mt. Sinai, according to the good book, he carried two stone tablets and on one of these was carved the words, "Six days shalt thou labor." The growing tendency is to cut this time down and some of the present day business men are not content with reducing it to five days but needs must take vacations two or three days in the week by devoting most of the day to the game of golf. Aside from the thought of a service shirked, it is a poor example to set the men below, who are apt to feel that they too can loaf all of the time that the "boss" is on the links. Beyond even the present urge for production, the principle of every man a worker, is the only safe basis on which a nation can rest and an ideal which pictures success as unproductive leisure is a dangerous one. The so-called captains of industry are today setting the example so that now every man who can by stretching his imagination, call himself his own boss, thinks that it is necessary to play golf at least three times a week to show the public and his competitor that he is a successful business man. The office boy of today has an ambition not to conquer the world but to be able to do the nine holes in one less than par.

During recent months those interested in the power industry in Oregon have been concerned over a movement which has gained headway in that state to beautify the highways by the planting of shade trees. The electrical men have been heartily in favor of this movement in general, but have foreseen that when fully grown

these trees may later prove a menace to power lines and a continual source of trouble. With this end in view an effort has been made to have only the smaller types of trees planted and low spreading varieties or shrubs substituted for the more troublesome species.

This experience may well serve as an example in other states. The tree planting movement is becoming general, both as a tribute to our soldier dead and also in the beautifying of highways, a project quite properly encouraged by the forestry interests and the federal authorities. It is in no way the part of the power company to discourage this laudable zeal—but it is a matter of proper forethought to consult with agricultural and forestry officials as to what species of tree may be suggested in cases where power lines already border the roads and might be seriously hindered. The public is quite ready to appreciate the point, and will welcome a constructive suggestion where a mere objection, although possibly effective, would arouse ill feeling.

The so-called headlight heaters and other types of quick and mobile heating have long since become popular in the home. There is, however, much good work to be done in the study and investigation of the possibilities of heavy heating in the home—such as the radiator placed in the fire-place and other types of this nature.

Great uncertainty exists as to the proper rates that should be instituted for such installations in order that the business thereby secured may be self-sustaining. No utility company in the West at the present time has made a complete study of this situation. The residential diversity factor that is created and the effect upon the primary as well as other substation peaks, and other factors involved in power delivery, are matters that merit the research of the engineer. There is no question but that heating of this nature has a possibility in districts having mild climate such as that prevailing in California and some of the Southwestern states, but the extent to which its uses should be advocated depends of course entirely upon the results of investigation. Some two years ago a very profound research was undertaken in this matter at Spokane, Washington, and there it was found practically impossible to devise rates within reason that could handle such loads in the climate prevailing in that section. The entire subject, however, presents such fascinating proportions in the way of new uses of electricity in the home that it certainly calls for immediate and thorough investigation.

The New Journal Service

The rapid progress which the electrical industry is now making in the improvement of existing appliances and machinery is always of interest to the man connected in any way with the industry. Consistently following its policy of being of service to the industry, the Journal of Electricity with this issue is adopting a new form of handling its "Latest in Everything Electrical" department. With the adoption of three columns instead of two and the use of more illustrations it is thought that the page will be more attractive and will better serve its purpose. A circular letter has been sent out to all the large manufacturers of the United States offering them the use of this page as an advance agent, to be used only for new material and electrical apparatus that is of particular interest to the West. Western apparatus will be given the preference, as the Journal of Electricity believes in the upbuilding of the West as an industrial center. This new service is but one of the many ways in which the Journal of Electricity is assisting in this upbuilding.

Building the Agricultural Load

(Electrical service for agricultural districts has been one of the features of electrical development in the West, where the demands of irrigation, coupled with the enterprise and generosity of the power companies in the matter of extensions and rates, have fostered an especially large agricultural load. The following article presents important data collected by the Journal of Electricity, showing methods of handling the industrial load in the West, with special reference to California power companies.—The Editor.)

Agriculture undoubtedly forms the backbone of the prosperity of the West. The first pioneering days when mining and stock raising were the major industries have given way, even in the frontier districts, to the day of the farmer. Recent statistics from Montana indicate that even in that stronghold of mining, agricultural products have exceeded mining output in value annually since 1917. The West is just now entering upon the third stage in its growth with a more intensive city growth and an industrial and commercial development which are a natural outgrowth of the production of the raw materials.

Intensive Electrification in Western Rural Districts

The agricultural load is therefore one of major importance to the power companies of this region. The unusual per capita use of electricity in the West, which averages 2.2 times that for the entire nation, is particularly applicable to farm conditions—and the prosperous agricultural districts of all Western states are looked upon as especially fertile fields for the sale of household and farm conveniences. In addition to this extensive use of electricity for domestic and general power purposes, the outstanding feature of the Western agricultural load is undoubtedly the large block of power which is used for irrigation pumping. This particularly centers in regions of arid climate such as the Southwest and Intermountain states, California probably representing the most intensive development along this line. Idaho and Utah have long been looked upon as irrigation centers and the eastern portion of Washington has many areas where electric pumping is required. The recent dry years in Montana have focused interest in that state upon the possibilities of irrigation with the result that electric pumping may soon become a feature of the agricultural load of that region.

The Southwestern states, of course, are entirely dependent upon irrigation for their agricultural development. It is estimated that ten million acres of agricultural land in the states west of the Rocky Mountains lies above the reach of gravity irrigation.

In order to ascertain just what the agricultural situation in the West was, as far as the power companies were concerned, the Journal of Electricity prepared and sent out a questionnaire to power companies throughout the West. Returns were very scattered, reasonably complete data being secured from the California district alone. This district, however, may be looked upon as an example of the ultimate development possible along this line in other Western states, with slight variations dependent upon historical and geographical differences, and its conditions are here analyzed as typical.

The total connected agricultural load in hp. for seven of the most important California companies is given as 375,708 hp., the largest single return being that of the Pacific Gas & Electric Company, who list a total of 167,701 hp. under various agricultural classifications. The district south of the Tehachapi reports the next heaviest load, with 135,000 hp. reported for the Southern California Edison Company. Another extensive pumping area is that of the lower San Joaquin Valley served by the San Joaquin Light & Power Corporation, with a pumping load of about 27,000 hp.



Several years ago the Pacific Gas & Electric Company sent over the lines of the Northern Electric Railway a demonstration car showing uses of electricity on the farm and in the home. This was visited by over 6000 persons and proved most effective as an educational campaign.

Educating the Farmer

All of the California companies report a very active policy of education and follow-up in agricultural districts carried on at the time the development was being instituted. It is interesting to find that this farm load is one of recent growth, most of the companies not reporting any activity along that line until about 1912. Various policies were adopted in the different districts. The Pacific Gas & Electric Company sent out a demonstration car over the lines of the Northern Electric Railroad which proved very successful in arousing interest, the exhibit being visited by practically every farmer in the district covered. Demonstrations were also given by the company in irrigating, cooking, heating, etc. Several companies report the extensive use of advertising matter sent to the farmer and reaching him through the papers that he reads. Among these are the Southern California Edison Company and the Southern Sierras Power Company. All the companies are active through their district superintendents and commercial agents and give special service to the farmer in seeing that the layout of his plant is the best for his purposes and in giving service after the installation is made. The success of these efforts is

to be judged from the fact that most of the companies are giving up their active campaign in recent years, the farmer being so well sold on the subject of electricity on the farm that in most regions of the state applications have been greater than the companies were able to fill.



The Santa Clara Valley district in California is probably the most congested area—electrically—of any rural district in the world, practically every street and lane being paralleled by a power line. Owing to the fact that it is a fruit-growing area the irrigation load comes early in the off season.

The present tendency of the power company is to concentrate upon the domestic load upon the farm with the idea that a higher individual load factor may thus be obtained. Winter irrigation and the diversity of crops and climate, as well as the other loads which supplement the agricultural on all systems, have given the California companies on the whole a very high annual load factor—but, of course, much of the distribution equipment in agricultural districts must be maintained for a load which is heavy only during the summer months. A household use of electricity and a general use of power for driving farm conveniences would nicely balance this discrepancy, the heaviest load here of necessity coming at a time when power is not being used for irrigation purposes. This use is already very general, as may be judged from the fact that more electricity is used upon the farms of California than in the entire remainder of the United States; but active campaigns are still carried on by many of the companies to introduce cooking and heating more extensively upon their rural lines.

Diversity of Rates for Agricultural Service

Rates on the whole are extremely favorable. In analyzing the situation here, perhaps the outstanding feature may be said to be the diversity of rates for agricultural service in the different regions of the state. There are two explanations for this, one historical and the other based upon the wide differences in climate and in the nature of crops between the various districts. When the agricultural load was first conceived as a possibility in the state there was, of course, no way of working out how much power would be used with a given installed capacity, nor the conditions under which this use would develop. A flat yearly rate was therefore

adopted, usually of about \$50 per horsepower-year. This did away with the necessity of installing meters, as well as the expense of meter reading over sparsely settled districts, and for some time worked very well. As the value of water was more and more realized, however, the electric motors were more and more overworked to supply the pumps, until the time came when it was no longer possible for the power company to supply power at the return allowed. In consequence, the flat rate has in most places been supplanted by a metered rate, although it still exists in some few instances. The present tendency is to allow an annual charge based upon the size of the installation, plus a kilowatt-hour charge graduated downward depending upon the amount of current used. The details of this type of rate again vary in different districts, depending upon local conditions.



All the Western power companies carried on more or less extensive campaigns in rural districts to educate the farmer. Above is shown a typical booklet distributed by a power company.

In general it may be said that the rate allowed for power on the farm has been very low, with the recognition on the part of the power company and the railroad commission alike that this was necessary during the period of the development of the country. Owing to the special expense of maintain-



DIARY OF AN OLD-FASHIONED FARMER'S WIFE

4.10 a.m. John pumps six pails of water for family use.

MORE ELECTRICITY NEEDED ON THE FARM

ing a distribution system for lighting in a rural district, lighting rates have been somewhat higher in these districts than in the cities, but it may fairly be said that power rates on the whole averaged somewhat lower than similar rates for industrial uses. The tendency at the present time is to increase these rates slightly until they bear the full share of their burden of the expense of generation and distribution.

During the year 1920 special conditions obtained, owing to the acute power shortage expected and experienced and in consequence a special rate was allowed by the Railroad Commission in some cases which fixed no minimum charge, but allowed payment upon a strict kilowatt-hour consumption basis. It was felt that the knowledge that he was paying exactly for what he used, would induce the customer to be more saving in his consumption of power. With the relief of the power shortage, however, the ready-to-serve and standby charge will undoubtedly be resumed as the more equitable basis for all concerned.

Typical Rate Schedules

Typical rate schedules as now in practice are given as follows:

Pacific Gas & Electric Company

This is the rate which covers about 90 per cent of the agricultural power installations on the company's lines.

RATE

(a) For installations of less than 50 hp.:

First	500 kw-hr. per meter per month.....	3.2c per kw-hr.
Next	500 kw-hr. per meter per month.....	2.7c per kw-hr.
Next	2000 kw-hr. per meter per month.....	2.2c per kw-hr.
All over	3000 kw-hr. per meter per month.....	1.7c per kw-hr.

Minimum Charge: \$7.00 per hp. per year but not less than \$30.00 per year

(b) For installations of 30 hp. and over:

Size of Installation—hp.	Rate Cents per kw-hr.	Annual Minimum Charge per horsepower
30 hp. to 49 hp. inclusive	2.2c	\$ 7.00
50 hp. to 99 hp. inclusive	1.7c	7.00
100 hp. and over	1.5c	7.00
100 hp. to 499 hp. inclusive	1.2c	14.00
500 hp. to 1499 hp. inclusive	1.1c	14.00
1500 hp. and over	1.0c	14.00

Fifteen per cent surcharge is made in addition to the above charges. Any installation may obtain the rates for larger sized installations by guaranteeing the rates and minimum under the larger installation.

Southern California Edison Company

The following basic schedule covers a large portion of the district of the Southern California Edison Company, with optional schedules for those who desire to meet special conditions.

GENERAL RATE

Capacity of Installation	Rate
Less than 5 hp.....	3.75c per kw-hr.
5 hp. but less than 15 hp.....	3.25c per kw-hr.
15 hp. and over.....	2.75c per kw-hr.

MINIMUM CHARGE

Capacity of Installation	Minimum Charge
Less than 5 hp.....	\$1.00 per hp. per month, but not less than \$2.00 per month.
5 hp. and over.....	\$6.00 per hp. for an irrigation season of six consecutive months, payable at the rate of \$1.00 per hp. per month during the six consecutive months.

OPTIONAL RATE

- (1) For installations of 5 hp. and over and for a guaranteed minimum of \$12.00 per hp. per year, payable at the rate of \$2.00 per hp. per month for an irrigation season of six consecutive months, the energy rate to be:
2.25c per kw-hr.
- (2) For a guaranteed minimum of \$1.00 per hp. of connected load per month, but not less than \$100.00 per month, for an irrigation season of six consecutive months, the energy rate to be:
2.25c per kw-hr.
- (3) For a guaranteed minimum of \$1.00 per hp. of connected load per month, but not less than \$200.00 per month, for an irrigation season of six consecutive months, the energy rate to be:
2.0c per kw-hr.

SPECIAL MINIMUM CONDITIONS

- (1) Pumping plant contracts operated under General Rule, and Optional Rate (2) and (3) where monthly minimum is specified, may be made with accumulative minimum, provided that the minimum shall be for amounts of 25% in excess of the straight monthly minimum. Such accumulative minimum to be upon a six months' or yearly basis, payable in monthly installments.
- (2) For the remaining six months of the year not included in the irrigation season to which minimum applies, no minimum to be charged, under General and Optional Rate as designated above, except when the accumulative minimum is on a yearly basis, but regular energy rate to apply.
- (3) Any installation may obtain the rate for larger size installation by guaranteeing the minimum under the larger installation.

San Joaquin Light & Power Corporation

These rates cover general agricultural service and represent the type of rate allowed during 1921 without minimum charge provisions in the interest of conserving water and power. They are subject to revision some time during the year 1921.

GENERAL AGRICULTURAL SERVICE

Installations with connected load of from 3 to 6 hp.:	
First 125 kw-hr. per month per hp. connected.....	2.4c kw-hr.
All over 125 kw-hr. per month per hp. connected.....	1.4c kw-hr.
Installations with connected load of 7 hp. and over:	
First 125 kw-hr. per month per hp. connected.....	2.0c kw-hr.
All over 125 kw-hr. per month per hp. connected.....	1.4c kw-hr.
No minimum charge during the year 1920.	

Special rates are arranged for lighting, heating, cooking and domestic power, these as a rule coming under separate schedules. The power rates in application on agricultural service in California as a whole will work out to about 2.5c per kw-hr. on the larger installations, the figure of course varying depending upon the schedule upon which rates are figured.

Financing Rural Extensions

To those familiar with the extension policies of the Eastern and Middle Western states where the agricultural load is not so generally sought after, the methods of financing extensions in practice in California are exceptionally generous. The general policy is for the companies to finance any extension up to the point where it will bring profitable returns. The method of determining this point is worked out in slightly different ways by the different companies, but figures out to about the same conclusion, that the company is willing to put in at its own expense an amount equivalent to three times the guaranteed annual income. If the cost of the extension is greater than this, the farmer is expected to advance the money, which will then be allowed him in amounts which bear a direct proportion to his monthly bill, varying with the different companies from 20 per cent to 50 per cent. Where the anticipated income is less than 20 per cent of the expenditure required, it is customary to ask a guarantee of the customer that the annual return to the company will come up to 33 1/3 per cent of the cost of extension.

A summary of the extension policies of the various companies may be given as follows:

Pacific Gas & Electric Company

General Agriculture:

Extensions made at company expense up to 3 times anticipated annual income.

If anticipated annual revenue less than 1/3 cost, the business permanent, the company will pay up to 3 times annual revenue, remainder to be advanced by consumer.

If revenue for any three years up to tenth year exceeds total cost of installation, excess to be refunded to consumer. The revenue for the tenth year for figuring refund shall not be figured as more than average for preceding three years.

Rice:

Extensions made at company expense up to 2 times anticipated annual revenue.

If cost more, difference to be advanced by consumer.

Refunds to be made, if income for any two consecutive years up to tenth exceeds cost of installation, tenth year to be figured at average of the two preceding years.

Southern California Edison Company

Extensions made at company's expense up to 2 times anticipated annual revenue.

Where more than twice and up to 3 times anticipated annual revenue, difference to be advanced by customer.

Advance refunded at 50% of monthly bills.

Where estimated annual income less than 1/5 of cost, entire amount to be advanced by consumer, not to be refunded; or guarantee of income to be made by consumer.

San Joaquin Light & Power Corporation

Extensions made at company expense up to 3 times annual revenue.

Where cost more than 3 times but less than 5 times annual revenue, cost to be advanced by consumer, to be refunded at 20% of monthly bills.

Customer may construct such part of line so that cost to company not more than 3 times annual revenue.

Customer may guarantee income at 1/3 cost of installation.

Extensions not usually made where revenue will be less than 1/5 cost.

Great Western Power Company

Extensions made at company's expense up to point of profitable returns.

Beyond this point, cost advanced by consumer and refunded at 20% of monthly bills.

Southern Sierras Power Company

Extensions made at company's expense up to equivalent of anticipated annual revenue.

Where cost greater but not more than 3 times anticipated annual revenue, consumer shall advance the difference, to be refunded on basis of 50% of monthly power bills.

Where estimated revenue exceeds 35% of cost, customer may pay total cost, receiving 6% on advance, refund to be made at 25% of monthly bills.

Where revenue more than 20% but less than 33 1/3% consumer to pay entire cost to be refunded at basis of 20% of monthly bills. Or customer may pay for part of line and come under one of above classifications.

San Diego Consolidated Gas and Electric Company

Extensions made at company's expense up to 3 times the anticipated annual gross revenue.

If cost greater, the difference to be advanced by the consumer as a deposit.

California-Oregon Power Company

Where cost of extension \$100 or less, made at expense of company where annual revenue 40% of cost of extension.

Where cost over \$100, made at expense of company if contract for 3 years guaranteeing annual revenue of 70% cost of installation.

If contract for three years guaranteeing annual revenue greater than 40% of installation, consumer shall advance sufficient to reduce cost to company to one and one-half times guaranteed annual income. This advance to be refunded to customer on basis of 20% of monthly bills.

If contract for 3 years guaranteeing annual revenue greater than 30% of installation, consumer shall advance entire cost of extension, this amount to be refunded on a basis of 20% of monthly bills.

No extension to be made where guaranteed income does not equal or exceed 30% of the cost of extension.

Where guarantee not acceptable, consumer shall advance entire cost of extension, to be refunded upon above basis.

At the present time a new basis for the determination of extension expenses is being looked for which will determine more fairly exactly what share the company can afford to bear with profit to itself than the present more or less arbitrary 33 1/3 % rule. The intention back of the various rulings, however, is one of liberality, with the idea that the agricultural load is one worth encouraging and one which can only prosper under conditions as favorable as possible to the consumer.

The situation in California is of course, not wholly typical of other Western conditions. Returns from Arizona, where the electric pumping load is an advantageous supplement to such irrigation projects as that of the Salt River Valley, would indicate that extensions here are made entirely at the farmer's expense, but as this is a cooperative organization, conditions are of course not strictly comparable.

The Telluride Power Company of Utah reports rates of \$6.00 per hp. per month, which figure out about 1.11c per kw-hr. Extensions are made at the cost of the customer, being later refunded at the rate of 25% of his power bill during a contract period of five years.

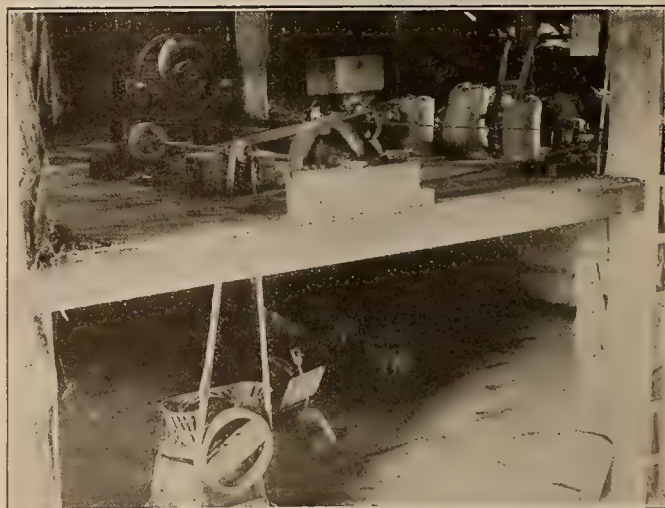
On the whole the agricultural load is looked upon very favorably in the West and special efforts are made to make electric service attractive to farmers. The returns to the power companies on this type of load as indicated by the responses would seem to have amply justified this policy.

FARM MOTOR INSTALLATION

The accompanying picture shows an installation of a 5-hp. motor operating a grain crusher, hay cutter and root cutter. Since the photograph was taken a milking machine and separator have been added to the same line shafting.

The same consumer has also installed a 10-hp. motor, 220-volt, three-phase alternating current, for operating a silo filler. It is controlled by a double throw switch, enabling the company to install a transformer for capacity 10-hp. instead of 15, and also reduces the monthly minimum charge to \$5.00 instead of \$7.50.

The average monthly consumption for the last 12 months has been 51 kw-hr.



This motor operates a grain crusher, hay cutter, root cutter, milking machine and separator. The installation is on a British Columbia farm.



DIARY OF AN OLD-FASHIONED FARMER'S WIFE

4:45 a.m. John and boys milk 72 cows by hand. Good appetite for breakfast.

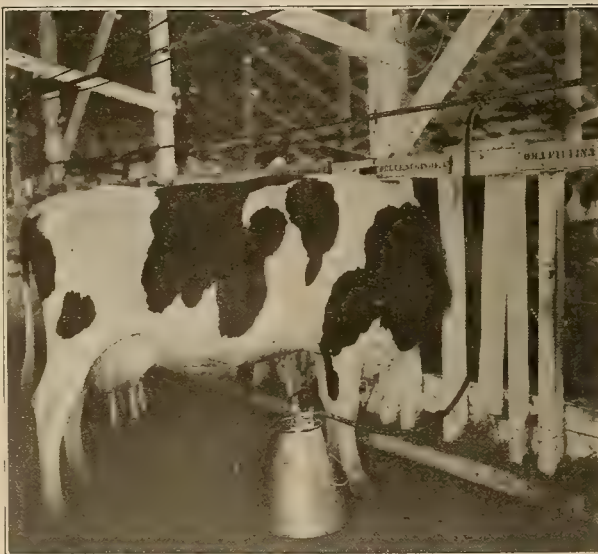
MORE ELECTRICITY NEEDED ON THE FARM

Electrifying the West's Most Important Industry

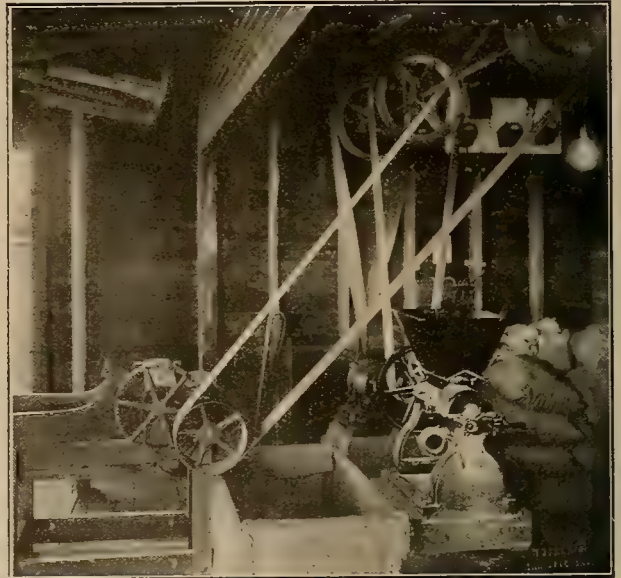
WHERE THE FARMER IS THE POWER
COMPANY'S BEST CUSTOMER



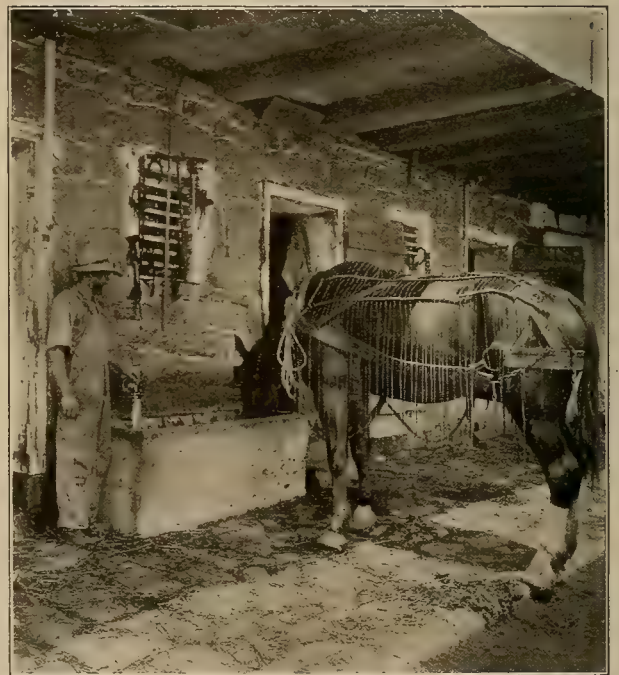
Electric lights in the farm buildings are among the greatest benefits which electricity brings to the farmer. Not only are they clean, convenient and safe, but they enable the farmer who must use the last daylight hours in the fields, to do certain indoor work after dark, which would be impossible by the light of a lantern or kerosene lamp. The elimination of the fire hazard is also very important.



Where electric milking machines are used one person can attend to the milking of several cows simultaneously, thus saving a great deal of time on this otherwise laborious task. Milking done this way is not only quicker and easier but far more cleanly and satisfactory.



The use of a single motor to drive a number of different machines is characteristic of farm installations. In this barn the motor operates a feed cutter, and the idle belt just to the left of it goes down a pit behind the cutter where it can be connected with a pump for filling the tank on the roof, or supplying water for irrigation. Note that the barn is also lighted by electricity as it is too dark even during the daytime for work to be carried on easily and safely.



Only those who have drawn and carried bucket after bucket of water from a well for watering stock, for washing, cooking and a thousand other uses can fully realize the inconveniences of the old-fashioned farm, and the savings of an electrically-pumped water supply.

TEN MILLION ACRES OF AGRICULTURAL LAND IN THE WEST REQUIRE IRRIGATION PUMPING



Sixty-three acres of Tokay grapes saved this year by electrical pumping produced 25,000 boxes of fruit, selling for \$3 to \$4 a box in New York.



A 5-in. pump operated by a 5-hp. motor and having a lift of about 8 ft., irrigates 20 acres on this farm. The motor replaced a gasoline engine and proved cheaper and more reliable. Rent for a similar stream of water would be \$12.00 per hour and could be secured for only one hour a week.



On this ranch a 50-hp. motor replaced a 32-hp. gas engine to run an air compressor. Note the portable transformers ready at all times for service. The development of special equipment for farm service is progressing steadily in response to the growing demand for electric power in rural districts. California has more motor installations per acre than any other state.



A row of Wickson plum trees in full bloom on a California ranch. One of the great advantages of this fruit crop is that it requires irrigation in the off-season—beginning in November and having its peak in April and May. This makes an excellent load factor, as the irrigation of other crops does not usually begin until June or July. The diversity of crops and of climatic conditions in the district of any one company and the growing tendency toward winter irrigation are factors which help to neutralize the seasonal character of the agricultural load. This particular orchard is in the San Joaquin Valley, a district representing a 2700-hp. pumping load.



Rice irrigation requires from six to eight acre-feet of water during a five-months season—twice as much as other crop irrigation requirements. This industry has come to depend almost entirely upon electrical pumping.

An Emergency Steam Plant for Rice Irrigation

BY RUDOLPH VAN NORDEN

(The rice industry in California has been developed during the last few years, with the aid of electrical pumping, into one of the largest and most important agricultural enterprises in the West. The following article tells of special measures taken during a power shortage to continue the necessary irrigation. The second part of the article will appear in the next issue. The author is a consulting engineer of San Francisco.—The Editor.)

Famed as it has become throughout the world for its varied agricultural abundance, California, less than a decade ago, was unknown as a land for rice production. Formerly, the cultivation of rice was thought of as possible only for tropical, or semi-tropical countries where there was a hot and humid climate and above all, a superabundant supply of water. In the great central valley of California, semi-arid in its natural state, irrigation was largely accomplished by means of the diversion of water from mountain streams, where the flow throughout the summer is limited. This use entailed the construction of gravity flow transportation systems of great cost and limited capacity and divergence.

Large Supply of Water Necessary

Rice requires 6 to 8 acre-feet of water per season, covering a period of five months. This amount is twice as great as other crop irrigation requirements. Solid blocks, tens of thousands of acres in extent, are intensively cultivated, and the gross quantity of water, and consequently the tremendous size and extent of the canals required to convey it, greatly exceed the possibilities of the older mountain systems. To make the demand for water even more exacting, the supply, unlike that for other crops, must be continuous. So necessary is this that, should the water fail for two, or at most three days, during the growing period, thereby allowing the land to drain, the crop would "burn up" under the intense summer heat and the season's harvest would be lost.

Growth of Rice Area in California

It was about eight years ago that the first experiments were made, near Sacramento, in growing rice on the flat alluvial lands on the west side of the Sacramento river. These lands, in many cases, were unsuited for other crops, because of the alkali content in the soil, and were therefore uncultivated. The

early experiment has resulted in so phenomenal an increase in rice farming that during the season of 1920 there were more than 200,000 acres devoted to this crop, extending over an area whose dimensions from north to south are one hundred miles, and from east to west ten to twenty miles, on both sides of the river.

Low Water Supply and Power Shortage

The Sacramento is the only river source from which sufficient water to irrigate this vast area is procurable. Its low summer flow will average 5,000 sec.-ft., but the variation between years of maximum and minimum runoff is considerable. During the past summer the flow reached the unprecedented low value of about 3,300 sec.-ft. The year 1920 has been the fourth in a series of low-flow years for the rivers of central and northern California, and the low flow in the Sacramento was a result of the general low minimum flows of all the tributary streams whose sources are in the high Sierra Nevada mountains. This condition had a direct bearing upon the output of the hydroelectric generating plants located on these streams which furnish the power for pumping water from the Sacramento river for rice irrigation.

In view of the palpable shortage of power during the summer of 1919, when the power companies were put to the limit of their resources to furnish power service for pumping, and also because of a very material increase in the rice acreage proposed for the present year—much of which, in view of the probability of another dry year, the power companies refused to contract for—an acute power shortage for the season of 1920 was foreseen early in the year.

The Railroad Commission Called In

Following more or less misunderstanding between the producers and consumers of power, representatives of the former met with the Railroad Com-

mission March 1, and by concerted action placed with the Commission the right to distribute and dispose of the probable available power over the period of the summer shortage. This arrangement applied to the service for new consumers as well as to the curtailment, if necessary, of power already furnished to old consumers. News of this action was the cause of some consternation among rice growers, and following a mass meeting held at Willows on the evening of March 2, the entire delegation appeared in a body before the Railroad Commission for the purpose of cooperating with the Commission and devising ways and means for unified action, in the spirit of give and take, with a view to forestalling what promised to be endless litigation. At this time the Power Administrator of the Commission, Mr. H. G. Butler, announced that a power shortage might be expected amounting to possibly 25 per cent of the probable requirement, including new services, for the season of 1920. In the several meetings which followed committees were formed to deal with various phases of the power shortage, as well as a water shortage, which loomed before all users of water from the Sacramento river. As the result of these conferences, most of the rice growers agreed to a reduction in their power supply not to exceed 25 per cent, and it was decided that some of these growers who were putting water on their lands for the first time, but who had already expended large sums in the preparation of the land, should have some power allotted to them.

The Emergency Water Conference

The shortage which loomed as a possibility throughout the irrigation season for all users of water from the Sacramento river threatened further conflict and litigation should the supply fall short of the demand, and to forestall such actions and insure fair apportionment members of various state departments, including the Railroad and Water Commissions, and the State Engineer, together with members of the United States Department of Agriculture, Geological Survey and Board of Army Engineers, formed the Emergency Water Conference. The water users, in order to cooperate with the state control, turned over their water rights, thereby placing with the conference the apportionment, or proportionate curtailment of their diversions. Mr. Paul Bailey, of the State Water Commission, was appointed Water Master, in official charge of all diversions, a duty which he performed throughout the irrigation season.

Municipal Water Districts

Rice irrigation is necessarily handled in large blocks, the water in each instance being pumped from the river through one or more pumping stations, delivering into main canals which distribute through laterals. In most instances single landowners would be unable to finance the cost of such a system, so that in a number of cases groups of contiguous owners have formed together into state corporations known as Municipal Water Districts. These districts are created under the California law known as the "Wright Act," amended by the Legis-

lature of 1917. Of these districts so formed, the Provident District is the second in point of extent of the rice acreage irrigated from its canals, there having been throughout the season of 1920 more than 25,000 acres so served. The river pumping plant for this district is located near Sidd's Landing, about one mile south from the old, now abandoned, town of Jacinto—the home of Frank Glenn, famous three decades ago as the "Wheat King," after whom Glenn county was named. Before the railroad running north into Oregon became an established fact Jacinto was the head of navigation for a part of the year, and was not only a wheat shipping point but a stage station at the beginning of the long overland journey into Oregon and Washington. The Sidds Landing plant contains five pumping units driven by induction motors with a combined capacity of 2,300 horsepower and delivering 550 sec.-ft. of water into the main Provident canal. This canal flows westward and then southward, branching many times, and serving a district which is twenty miles long from north to south and ten miles wide.

At a number of points it is necessary to raise the water into diversion canals and this is done through "booster plants." There are four of these boosters, requiring in the aggregate 300 horsepower. There is, in addition, another district which received most of its water from these canals through drainage. This district has a power requirement of 900 horsepower, so that the total power necessary, in terms of installed motor capacity, is 3,500 horsepower.

Meeting the Problem in the Provident District

Immediately upon the conclusion of the conferences before the Railroad Commission in which it was seen that a power shortage was probable, a meeting was called of the landowners and tenants of the Provident District. The situation was briefly outlined and the river growers were told that to secure their full water quota and their crop it would be necessary to build a steam generating plant of sufficient capacity to make up any possible shortage which might occur in the power supply, and that funds for the construction of this plant must be immediately forthcoming in order that there should be no delay in beginning the work. The hat was then passed among the forty or more land owners and lessees present, and within ten minutes approximately \$100,000 had been subscribed.

This solution of the prospective power shortage appeared attractive to those concerned. But to work it out in the time allotted and within the amount subscribed involved a new group of problems for the engineer and contractor. It was generally conceded that a plant with capacity of at least 1,000 kw.



DIARY OF AN OLD-FASHIONED FARMER'S WIFE

5:30 a.m. Skim 45 gallons of milk from last night's set.

MORE ELECTRICITY NEEDED ON THE FARM

would be necessary, and if the evaluated cost of existing modern plants be any criterion, the fund available would fall far short of the amount which might be required. But by far the most serious difficulty was the time allotment for completion. It was then nearly the middle of March. By June twentieth, in all probability, the power company would have begun drawing water from storage to operate its generating plants, and shortly afterward the shortage of power would become acute. This gave little more than three months to make designs, obtain boilers, turbo-generator and machinery, transport them to the power site, erect the plant and place it in operation.

Arrangements for the building of the plant were in the hands of Mr. P. B. Cross, one of the largest landowners, who in turn placed the design and supervision in charge of the writer, with instructions to build the plant and get it operating within the time limit, and with the amount of available funds. A contract for its construction was entered into with Leonard F. Youdall, of Stockton, the builder of the Sidd's Landing pumping plant and other similar plants. The plant was built and placed in operation practically within the time and cost limits, and the results were obtained for which the installation was intended.

ELECTRICITY ON CALIFORNIA FARMS

BY L. J. FLETCHER

(The large part played by electricity in Western farming is emphasized by the fact that the state university in California includes in its regular agricultural curriculum the installation and operation and maintenance of electrical machinery. The following account is by the head of the Division of Agricultural Engineering, University of California.—The Editor.)

Power farming is the rule in California. The farmers in this state use over 33,500 electric motors, which total above 302,000 horsepower. Over 80 per cent of these motors are used for the operation of pumps for irrigation. The ranchers do not make occasional, but almost constant use of their motors; records of 2400 hours per year are not uncommon, and in the rice districts continuous runs of 1400 hours are not infrequent.

The electric motor is an ideal power for operating the centrifugal pump. Owing to its high speed it may be direct connected; it requires remarkably little attention for the services rendered, and may be operated by comparatively unskilled labor. This last is a considerable factor, since the success or failure of the gas engine or tractor depends to a very large degree upon the operator. The fact that there are but two parts of the motor to lubricate, and that these parts require attention but a few times each season, make it an almost "fool proof" machine.

While the greater horsepower is used in the operation of pumps, threshing machines, grinders, etc., the greatest benefit is derived from the use of electricity in the farm home. Here it is used to save time and labor of the usually overworked farmer's wife. It is one of the largest factors in making farm life more enjoyable. Aside from lighting the

farm home, electricity is used to operate the washing machine, vacuum cleaner, cream separator, sewing machine, and now small refrigeration plants are made from a small electric motor.

Lighting of the farm house is one of the biggest advantages of the use of electricity in the country. There is practically no fire risk if the wiring is properly done. This is especially true of the low voltage systems which are used where services from the central stations cannot be secured. This lighting is quiet, convenient, cool in the summer time, and sanitary.

New uses are continually being found for electricity, one of these being the lighting of poultry houses. One of the main reasons why egg production falls off during the winter months is due to the comparatively few daylight hours. Egg production has been materially increased by lighting the poultry house a few hours early in the morning and in the evening. The fowls eat more food and produce more eggs. The rancher has an opportunity for exercising his ingenuity in solving many of the problems arising with the use of electricity. One poultryman discovered that when the lights were suddenly turned off in the poultry house in the evening the chickens could not find their way to the "bed room" and were forced to spend the night in the "dining room." The use of a resistance rheostat, which causes the lamps to become dimmer at frequent intervals, so imitated the twilight hours that the chickens stopped their activities and found their way to the roosts before the house was completely darkened.

There are two main sources of electricity for the rancher, the central station and the independent plant. The majority of the central stations distribute electricity from large hydroelectric plants located in the mountains. There is just so much oil and coal in the country, but the power of the running water is renewed annually. The rancher in this state is exceedingly fortunate to be able to look towards the use of this energy, which may truly be said to be inexhaustible. But a very small per cent of the available water power is as yet developed. Undoubtedly the uses of electricity will multiply rapidly as more of it becomes available.

Students in the Agricultural College of the University of California may enroll in a number of courses offered by the Agricultural Engineering Division at the University Farm, Davis. These courses include the operation, care and testing of pumps and motors. Belt lacing, lining up of shafting, figuring of pulley speeds and sizes, wiring for electric lines and small motors, and the care of storage batteries is included in the various courses. For those ranchers who operate independent plants a knowledge of the operation and repair of gas engines is important, and a complete course is given in this subject.

To gain the largest benefits from electricity, the rancher should know how to install and repair the various electrical appliances which he uses. The California farmer's problems are rapidly becoming those of selecting, operating or repairing his mechanical equipment. The University realizes and is providing means of education along these lines.

The Woman on the Farm

(The farm-lighting set has proved to be a good pioneer in taking electricity to the farmer before the power company is able to run its lines into a sparsely populated rural district. In the following article the point is brought out that the service of these sets is especially essential to the women on the many farms still awaiting power company supply.—The Editor.)

"Twenty miles from the nearest railway station." To the city dweller such an address conveys perhaps an idea of unattractive isolation from community amusements and companionships, but the full extent of the real "inconveniences" is not always



The farmer's wife can prepare the dinner while the electric washing machine does the washing. For a woman who has more actual duties than can be accomplished in a normal working day this possibility of doing two things at once is invaluable.

realized. To be twenty miles from the nearest railway station involves a good deal more than a long drive over bad country roads to a little country station to get into any kind of communication with the outside world. It means no water supply such as the city dweller has come to look upon as an essential commonplace. It means usually no lighting system, no gas supply, no electric power. There are at present in this country about 9,000,000 farms outside the limits of districts served by power companies, and of these only 300,000 have farm lighting and power sets as a substitute.

The Power-Light Set for Farms

In spite of the rapid entry of the power companies into the rural districts, there are still multitudinous obstacles to running lines into the many areas where there are only isolated farms. The isolated plant is the immediate solution of the difficulties of the isolated farm, and the growing realization that electric power for the farm is not a luxury but a necessity is steadily increasing the sale of farm lighting and power sets. An interesting point was brought out during the war, when the farm lighting and power set was originally classified among non-essential products. A large manufacturer of these sets sent out questionnaires to the users, and the replies were so convincing that the plants thereafter were officially pronounced "essential," and their manufacture an essential industry.

Luxury and Necessity

It may be contended that electricity is still a luxury in a great many respects, and therefore no more an absolute essential on the farm than in the city home. A glance at the different conditions in rural and city districts is all that is necessary to refute the claim, and in this connection the housewife's point of view is perhaps the most illuminating. Take from the city housewife her electric supply and she is of course immeasurably inconvenienced, but life is still comparatively modern and normal. Turn to the conditions with which women on thousands of isolated farms have to contend, and you find first that there is no such thing as a faucet in the house. Every gallon of water for dish washing, house-cleaning, laundry work, cooking, drinking, bathing, has to



With an electric iron the farmer's wife can do the ironing in the coolest part of the house, instead of having to walk to and from a hot stove all the afternoon.

be pumped from a well and carried in bucket or pitcher to the place where it is needed. There is no such thing as a gas range to which you touch a convenient match when water must be heated in kettle or cauldron. Hot water on the old-fashioned farm means lighting a fire in an old-fashioned stove—and cleaning up afterwards. Picture not being able to get a glass of hot milk or a cup of tea without lighting a fire. A city water supply and a city gas supply alone, with all the varied conveniences they imply, can make the domestic routine of the city housewife humanly workable. But neither of these is available to the woman on the farm, and her need of electricity is for this very reason so much the more imperative.



DIARY OF AN OLD-FASHIONED FARMER'S WIFE

5:45 a.m. Cook breakfast for 16 farm hands on wood stove.

MORE ELECTRICITY NEEDED ON THE FARM

The Manual Labor of the Farmer's Wife

Electric power is primarily a substitute for manual labor, and in this field again the farm housewife has a prior claim over the city housewife. The city woman has laundries within reach; the woman on the farm does her own washing—and a wash, usually, of a size and difficulty that would appal the average wife whose husband works in an office and whose children ride to school in a street car. Where the city housekeeper runs a carpet sweeper over the floor to take up the crumbs, the woman on the farm has to scrub. Where the city housekeeper cooks dinner for four and prepares a cold lunch for one, the woman on the farm often has to furnish three square meals a day for five or six hungry farm hands and as many children—and wash the dishes afterwards.

Moreover, the daily round of the woman on the farm does not end with the ordinary domestic duties. Often she milks the cows, feeds the chickens, makes the bread, skims the milk, churns the butter, and does endless other things that not only take time but are hard physical labor. In short, she has more than a normal working day, both in length and difficulty. She, more than any woman, needs the assistance of labor-saving devices. Domestic help is as scarce as other kinds of labor, and the round of duties which falls to the share of the average unaided housewife on the isolated farm has come to be beyond reason.

Of every 100 women on farms, 36 of them help with the milking, while 79 of them trim and fill kerosene lamps and all but four do the family washing. The women feed the poultry on the farm and usually the corn is shelled each day as they feed it.

Shortening the Working Hours

Besides the great saving in actual physical effort which the use of electricity entails, there is a special advantage for the farmer's wife in that it allows her to do several things at the same time. While the electric washing machine attends to the laundry work, she can put away the dishes—washed in the electric dish-washer—and prepare the dinner; she can feed the chickens and put the baby to bed while the electric separator skims yesterday's milk; she can mend clothes while the electrically-driven churn makes the butter. By electric lights she is saved the filling and trimming of oil lamps, and the extra washing made by the smoke; by an electric iron she is saved the long hot hours of carrying heavy stove-heated irons backwards and forwards from board to stove—and so on through an almost endless list, with time saved, strength saved, and discouragement averted.

The Farmer's Labor Problems

With the higher standard of living, the spread of new ideas, and the rapidly increasing comforts of the city, it becomes more and more impossible to maintain successfully the old conditions of labor on the farm. This applies to the regular farm work as well as to domestic work. Actual instances are re-

corded of a farmer being unable to engage help because there was no running water and no bath in the farm house. The continuous water supply obtainable from a motor-operated automatic water system will alone save the farmer and his wife enough in time, trouble and actual dollars to justify the installation of a power-light set.

Numerous devices for the application of electricity to all kinds of farm work have already been developed, and many more are likely to follow. Besides the more elaborate applications the farmer can saw wood and run his grindstone, his corn sheller and his feed chopper all by electricity. With the scarcity and high prices of farm labor the reduction of the time spent on chores is no small item. An elaborate chart kept by the owner of a farm in great detail for one month showed an actual saving of \$104 during that period through the use of electricity for lighting, water supply, dairy work and housework. One hundred and four dollars every month for twelve months adds appreciably to the year's savings, to say nothing of all the other aspects involved.

More Light on the Farm

Next to a water system, good lighting is perhaps the greatest saving and benefit to the farmer. With electric lights in the farm buildings it is possible to do work after dark which would be absolutely impossible by the light of a kerosene lamp. It is often essential for the farmer to use the last possible hour of daylight in the fields. From the point of view of safety it is hardly necessary to point out the savings of electricity when one considers the difficulties and dangers of perambulating around a farm by lantern light, falling over a scythe, or setting fire to the barn. In large poultry farms electric illumination has been found invaluable not only in increasing the laying capacity of the hens, but in providing a safeguard against thieves. A lighting system operated from the house quickly discourages the night marauder.

The need for making the farm more attractive is imperative. The outcry against the exodus from the rural districts, the congestion in the cities, and the insufficient labor on the land is not without foundation, but part of the solution is perhaps not so complex as some have thought.

The Eighteen-Hour Day

It is the woman on the farm, however, who has the most urgent immediate need of electric power. The electrical home campaigns in the cities only serve to intensify the contrast between her lot and that of her already normally comfortable city sister. With the development of the power-lighting set for the farm there is no longer any need to wait for the arrival of the power company, even if this is to be delayed only for a year. The wiring for the farm is adapted to the service of the latter. Primitive conditions in agricultural districts are no longer unavoidable, and it is time to shorten the eighteen-hour day of the woman on the farm.

Electric Operation for Fresno Raisin Packing Plant

(As mentioned in the article below, practically all the raisins in the United States are grown in California. This means an enormous industry which must be carried on electrically. This description of the largest raisin treating and packing plant in California shows the important part electrical power plays in this industry.—The Editor.)

With the exception of very limited quantities produced in Utah, Arizona and New Mexico, all the raisins grown in the United States are produced in California. Of these Fresno county is responsible for 77 per cent. An estimate by the California Associated Raisin Company shows that in 1918 Fresno county produced 129,500 tons of raisins for which some \$14,250,000 was received by the growers.

The main portion of these raisins are handled by the California Associated Raisin Company itself through its \$3,000,000 seeding and packing plant, the second unit of which has recently been completed. This plant is entirely operated by electricity, constituting one of the largest consumers of the San Joaquin Light & Power Corporation. The Association has a membership of 8,000 growers and handles more than 90 per cent of the raisins grown in this region. For a time the seeding and packing was cared for through commercial companies but in 1918 the Association took over this end of the business and now owns and operates thirty-two modern packing plants and warehouses, the largest of which is that which is just completed in the southern section of the city of Fresno. The site of this mammoth packing plant covers 20 acres of ground and here from six to seven hundred tons of raisins a day are handled during the busy season.

The Packing Process —

The packing process in brief consists of first dry heating the raisins from 3 to 4 hours, which makes it possible to readily remove the stem, stemming them, reheating them in the presence of steam, seeding them and then packing the finished product in cartons ready for shipment. All this is handled by electricity except the actual packing process—and a machine has now been devised which cares for this and which within a short time will be brought to a state of sufficient perfection so that it can take over this portion of the work.

As handled at present, the raisins are received in sweat boxes in loose form, partially stemmed. They are loaded by hand on to a belt conveyor, from which point they do not need to be rehandled until ready for the cartons. The conveyor and elevator takes them to an upper floor of the new building

where they enter the drier. A battery of ten driers has been erected through which the raisins pass, subjected to a heat of 140 deg. F. from 3 to 5 hours. These driers consist of a series of great trays or "drapers" in constant motion. The raisins drop from one to the other of them to the last tray, where they are again cooled. This loosens the stems and renders them brittle, so that in the stemmer, which is the next machine they enter, the stems readily drop off. A belt conveyor transfers them from the drier to this apparatus, where they are subjected to a screw-like motion. From here they go to the grader, a series of trays with holes of graded sizes kept in constant agitation, so that the raisins drop from one to the other.

Before the use of these driers a tray system was used, by which the trays were simply inserted and baked for a given period. The present electrically operated method saves from four to five hours in time and the services of from 10 to 15 men.

Belt conveyors and elevators again take the fruit from here to the upper story, where they are transferred to the other building. A so-called "elephant's trunk" which swings constantly from side to side of an elongated hopper ingen-

iously secures the even distribution of the raisins on the conveyor. From here they are transported by means of a bridge to the adjoining building where they are seeded and packed.

Magnetic Pulleys for Extracting Refuse —

There is always danger of nails or other iron refuse being included among the fruit which would endanger the machinery of the seeders, as well as prove objectionable if not caught—and a system of magnetic pulleys has been devised by which practically all metal is extracted as the raisins pass between the two buildings. The current as supplied to the factory is, of course, a.c., but a simple d.c.



The new Sun-Maid City Plant which has recently been completed in Fresno, California. 210 motors with a total capacity of 3500 hp. are used to carry on the many processes of treating and packing.



DIARY OF AN OLD-FASHIONED FARMER'S WIFE

6:00 a.m. Wash 162 dishes with water heated in tea kettle.

MORE ELECTRICITY NEEDED ON THE FARM

generator supplies the necessary current for these magnets, as well as for those used between the "processor" and the seeding machinery.

In the second building the raisins are now distributed between a battery of eight "processors." These are great revolving containers in which the raisins are treated by steam, softening them after the drying process and putting them in good shape for passing through the seeders. Before passing through the seeder, the raisins again pass over magnets which remove any metallic material which may have escaped the magnetic pulley of the belt conveyor.

The Seeding Process —

The seeder consists of rubber rollers which flatten the raisin and bring the seeds to the surface, and a saw roller which extracts the seeds without greatly injuring the texture of the raisin. The seeds

process from sweat box to freight car will be accomplished by electricity without the raisins being touched by human hands.

From the packing tables the cartons are transferred in boxes by belt conveyors to the floor below, where they are nailed up and again conveyed to the waiting freight cars. The seedless raisins in the meantime have been going through a similar process (except of course that they need not be seeded) at the other end of the building, and pass through the packing department in similar quantities. About 350 tons of each are handled daily during the months of October, November and December.

Auxiliary Electrical Operations —

Aside from the main details of the raisin packing, various other needs of the factory are also electrically operated. The saws used to make up the



An electrically operated packing machine has been devised to fold, line, pack, weigh, refold and seal the cartons, thus relieving the many workers shown in this picture for other work.



The raisins are seeded in the machines shown above. Here rubber rollers flatten the raisin and bring the seeds to the surface where a saw roller extracts the seeds without injuring the raisin.

are removed from the teeth of the saws by a whisking device and are then sent along to a seed receptacle. From here they are removed by conveyor to the California Products Company which has an adjoining factory. A grape syrup and a grape seed oil similar to cottonseed oil is made from the seeds which find a ready market. Even the refuse remaining after this process is utilized by being baked into bricks used for fuel in industrial and even home furnaces.

The raisins themselves drop from the seeder direct to a hopper whence they drop to the floor below where packing operations are carried on. An ingenious system of vanes which can be shifted from side to side, permits the amount which is sent from any one machine to a particular table to be regulated, so that the output may be evenly distributed between the various tables. Each machine discharges to about four of these packing tables.

The present practice in packing involves the services of several young women in folding cartons, lining, packing, weighing, refolding and sealing. A machine for accomplishing all these steps has been worked out and is established at the present time on the mezzanine portion of this floor, where it has already demonstrated that it can do the work. One or two mechanical improvements are contemplated, but it is expected that shortly the entire

toothed roller are continually wearing out and losing teeth and a machine for replenishing these saws is kept in operation on the same floor. These are made by the simple process of stamping out the disks of metal and then punching them with teeth with a specially constructed machine. The rotary disks are then strung along an axle, giving the effect of a long cylinder of irregular indentations.

There are 620 motors on the system, ranging in size from $\frac{1}{2}$ to 100 hp. Current used is a.c., 60 cycles, at three voltages—110, 220 and 440-v. These motors are divided between the 32 plants of the California Raisin Association, 210 of them being used in the Fresno Sun-Maid City Plant. The total capacity of all motors is 3500 hp., the commonest sizes in use being the $\frac{1}{20}$ -hp., 3, 5, $7\frac{1}{2}$, 10 and 15-hp. motors. The $\frac{1}{30}$ and $\frac{1}{20}$ -hp. motors are used on the automatic weighing machines for filling small cartons with raisins in the seedless department.

Handling the Load —

In the Fresno plant 1000-kw. transformer capacity is provided for stepping down the current which is delivered at 10,000 volts to 440 volts for use in the factory. The connected load is 1232 hp., the maximum demand from the period from October to November, 1919, being 453.3 kw. The consumption for the same period was 146,800 kw-hr. In addition a 100-kw. transformer capacity is provided for

lights, which during the winter months average about 94 kw. A complete intercommunicating telephone system connects all floors of both buildings and all departments. Direct current is used only for the magnetic pulleys on the conveyor belts, employed for removing iron from the raisins before they enter the seeder, and for this purpose a small generating set is provided. The average load factor of the plant is about 75 per cent.

Steam is used for heating the driers and in the "processing," but not as motive power in any portion of the establishment.

Service to Employees —

Medical and dental service is provided for all employes through a welfare organization, supported in equal amounts by the employes and the management. Traveling nurses attend the workers in their homes, and special equipment is on hand in the plants for dental or surgical cases. Electricity is used here in the usual applications of a doctor's or dentist's office.

A chemical department which provides assistance to farmers wishing soil analyses and also experi-

ments in by-products from the raisin is part of the regular staff of the plant. Such progress is being



Electrically operated belt conveyors transfer the cartons from the packing tables to the floor below where they are nailed up and again conveyed to the waiting freight cars.

made in the development of by-products, that the company plans to take over this part of the business shortly and handle its own raisin seeds.

The Basic Industry

BY A. EMORY WISHON

(Public support of electrical development can be won only by proving to the public that its interests are bound up in this development. In the following paper, which was delivered before the Pacific Division, Electrical Supply Jobbers' Association, at Del Monte, October 23, the assistant general manager of the San Joaquin Light & Power Corporation tells the fundamental story of electricity in its relation to industrial and civic development.—The Editor.)

The development of the Pacific Coast depends entirely upon electrical development. It may be argued that the future of the electrical industry on the Pacific Coast is uncertain, as we face a great financial and a great labor problem. It is true that from the greatest financier to the ex-bartender this problem is being considered, but for once a common answer seems to prevail—constructive conservation and more production. But who is to conserve, and who is to produce more? Capital "passes the buck" to Labor, and Labor "passes the buck" to Capital.

The large banking houses have begun to withdraw credit from industries not essential, and are extending credit to industries that increase the production of essentials. It is a problem of mutual interest to Capital and Labor—and only by mutual action can disaster be averted.

Constructive conservation is the answer—more production on the part of every industry, business and individual. Quit "passing the buck." Do your part, no matter how small it may be, and encourage others to conserve constructively and produce more.

The public as a whole is talking constructive conservation and more production. Is there any industry in the world today that stands ready to do more in the production of essentials and in the conservation of labor, fuels and materials, than the electrical industry?

We who have studied the problems of the development of the West know that the West will not

develop ahead of its hydroelectric development. The greater portion of Western territory depends upon hydroelectric development for irrigation of its arid land if agriculture is to be further extended, and increase of agricultural production made possible. If factories are to be built in the West, cheap power must be obtainable in order to conserve fuel and labor.

How the Income Is Distributed

If work is to be added for the laboring man, development must continue. I will cite the instance where a delay on the part of a power company due to its inability to serve 600 new agricultural applicants in Fresno county caused a study to be made as to the effect of this delayed development on local industry, and the effect of electrical development on labor and local industry. In Fresno county in 1910 there were 16,799 homes. There were 6,245 farms, or approximately two homes in town for every home in the country. It was therefore apparent that when electrical service was rendered and the 600 new farm homes constructed, 1200 new town homes would be constructed, or 1800 additional homes would be built,



DIARY OF AN OLD-FASHIONED FARMER'S WIFE

7:30 a.m. Sweep and dust for 2 hrs., potatoes boiling dry in the meantime.

MORE ELECTRICITY NEEDED ON THE FARM

directly due to electrical development; and this does not include commercial buildings, factories or other construction made necessary to handle the products of the 600 farms, and to supply the trade which is made possible through this agricultural development.

The cost of the average town home in this locality, including building site, is \$6000, and of the country home without building site, \$5,070, or a total building construction program of \$10,242,000. A study was then made of the materials and labor that went into the average home, and it was shown by curves that were indisputable that the carpenter trade would receive 15.5% of this delayed building program of \$10,242,000; that the lumberman would receive 14% of this \$10,242,000, and that the plumber would receive 3.85% of this amount—and so on through the lists of material and trades necessary in the construction of the average home. This is an example of what the electrical industry can do in increasing production and creating pay-rolls.

Economies and Production

Now as an example of what can be done in conservation—today the company I represent furnishes current to nearly 3000 oil wells. The average well uses approximately 100 kw-hr. daily, yet if this well were operated with an individual steam plant the average daily use of oil would be in excess of two barrels per well operated. Practically all the power that goes to supply these wells is hydro, and consequently these full two barrels of oil per well are conserved. Or, estimating 2500 wells operated, a conservation of 5000 barrels per day or 1,825,000 barrels per year. Even estimating that the wells were operated by utilities using steam for fuel, the average number of kilowatt-hours produced per barrel of oil by power companies of the state, I believe, will be approximately 200 kw-hr. Or, if these same wells were served with utility steam-produced power, a saving of 75 per cent on the fuel would still be possible. I cite this example for the reason that when you can pump oil from the ground with electricity at such a saving, it leaves no argument on the saving that can be made after this oil has been transported to points distant from the field.

More production—greater conservation, is what the nation is clamoring for. If we can put the idea over with the public, of what the electrical industry stands to do in relieving the present tense economic situation, then I ask you if the electrical industry should not have the brightest future of any industry in the nation today; and should it not receive the political, individual and moral support of the people as a whole?

The Self-Interest Appeal

But the public does not understand the electrical language, and it must be driven home to them in terms of self-interest, by proving to the individual of that public what the electrical industry is doing for him—what the electrical industry means to him in dollars and cents, and what lack of electrical development means to him in loss to his individual business. Prove your case to the individual by proving where that individual's pocketbook is hurt when your

business is hurt, and you will have a convert who will see that your business shall prosper. It is no new theory. It is as old as man. Self-interest is that element that causes strife, greed, war, ambition, strikes, profiteering, and even enters into love. It is largely responsible for the present unsettled condition; yet it can be capitalized to the benefit of the electrical industry and for humanity. It is the solution of the present national condition.

To put the story across with the people in order that we may perform this great service in the solution of the present national problem, and that we may prosper in our business, may seem a great undertaking.

There was a time when the waters of the seas offered an impregnable barrier. Boats were unknown. But the very fact that those seas were a great part of the universe meant that they must be capitalized into bearers of burdens; into lanes of transportation—and they were.

Fire in its volcanic origin, or through lightning, meant only death and destruction to the natives. Today we have capitalized that destructive element into probably the greatest worker for and comforter of mankind. Even in the frozen Arctic the ice that would kill by freezing is turned into homes to protect from the cold.

Selfishness, self-interest is a great constituent part of humanity. It cannot be denied or eliminated. Since the beginning it has been evident in every man every day. Creeds or philosophy have not killed it—though in some instances they have eliminated one line of self-interest by instilling a new thought that offers a greater self-interest. The Golden Rule, probably the only passage in the Bible that is left entirely to individual interpretation today, is simply a rule of right and wrong, based upon self-interest.

To Let the People Know

We as an electrical industry are the foundation upon which all future development of the West must be built. To continue, we must finance. To finance we must have a protected investment, and a fair rate of return. To make this possible the people must understand this story. And that the people may be made to understand, the story must be told so that the individual interest is appealed to; and that individual interest can only be secured by proving to the individual what electrical industry and development means to him in dollars and cents; in better standards of living, in more production and greater conservation. His self-interest must be developed.

It is a big undertaking, but it can be done when every man in the electrical industry knows the story; sells the idea to his wife and to his mother-in-law—which will probably be a real test of his ability to sell the idea to the public. It is basically a truthful, simple story; one that will be listened to with interest by civic organizations, by individuals, and by children in the school. When the electrical industry qualifies in putting this story across to the public, then there will be no doubt of the future of the electrical industry.

The pioneers have controlled the waters of the Sierras, moulded dams and brought the electrical industry to the point where it is today. It is up to us of the electrical industry today to control and mould the public opinion upon which the future of the electrical industry depends.

FINANCING PUBLIC UTILITIES IN THE WEST

BY A. N. KEMP

(A timely paper on the subject of Junior Financing is this article by the comptroller of the Southern Edison Company. It points the way to new methods of securing public good-will in financing the vast basic industry for the industrial development of the West and adds to our present day knowledge a treatment of the subject by an authority that will have great weight throughout the West.—The Editor.)

In the East, for instance, industry has grown up where coal, oil, or gas is most available, and now that the diminution of these is in sight, industry is energetically looking for another source, namely the "white coal" which we have. The three Pacific Coast states have forty-four per cent of the undeveloped power, and have heretofore been leaders in development of electricity, consequently they look for large industrial growth. The climate also is becoming a real industrial asset.

Programs have been adopted by the utilities to develop large amounts of hydroelectric power at an estimated expenditure in California alone of \$50,000,000 a year. How is this money to be raised?

Financing Development at Home

Before the war, Europe, being fully grown, had a surplus of created wealth which was available for investment in other parts of the world, and industries of this country were able to look to Europe for funds. During the war this condition changed, and now we cannot look to Europe; but just as the United States formerly looked to Europe, now California looks to the East.

The East we use for marketing of our senior financing, consisting of bonds, which should provide from two-thirds to three-quarters of the money, the bonds being sold through Eastern bankers. Now, as to stock, inasmuch as this development is for our own benefit, we should selfishly and patriotically handle the stock at home, so as to retain active management and direction of our development. As there is a large demand for funds, in competition with others we must offer an attractive security.

Development of our utilities is much bigger than any man or group of men, than any utility or group of utilities, and requires and needs the support and help of all the people. The Railroad Commission has studied this situation, has awakened to it, and realizing the responsibility which goes with its authority, will help utility development. President Edgerton has shown a very active interest and has promulgated some new ideas in public utility affairs which should be of great assistance.

A Financial Reserve

One of these is the Financial Reserve. He says that a utility should have some means of insuring the payment of its interest and dividends without

constant fluctuation in rates. Electric utilities have fluctuating operating expenses due to dry or wet years, and the establishment of a reserve out of which funds can be drawn to make up shortages in dry years is a necessity. In other words, when operating expenses are high and use up part of the gross, this reserve will be drawn on to make up the difference so as to insure the continued payment of interest and dividends. This would be an element of strength in stabilizing the value of public utility securities.

Distributing Rewards for Efficiency

Another plan is what is known as the Reward for Efficiency which, briefly, is that the utility surplus remaining after paying out of its gross revenues operating expenses, depreciation, reserves, interest, dividends, etc., should be used to provide 50% to the public, 25% to the stockholders, and 25% to employees. The public is entitled to a share because it has been instrumental in building up the business to this resulting improved operating ratio. Employees are entitled to a share as an inducement to improve further still their personal efficiency. The company through its stockholders is entitled to a share by virtue of the condition of its credit and its operations as a corporation.

The Electrical Industry a Public Servant

It is an incontestable fact that the development of our country depends on the development of the utility, and they can only grow together. Development work is in this sense, therefore, a patriotic one in which the public is perhaps more concerned than the utility itself. In other words, the electrical industry is a public servant and must develop in line with the public's wishes; in return it should receive a just reward.

IRRIGATION IN MONTANA

Although the Montana Irrigation Commission has been in existence less than ten months, a survey of the work accomplished is most gratifying. The principal work has been the examination of proposed districts. The petitions now before the Commission embrace a total of 168,700 acres. The largest single district considered is the 90,000-acre project in the Judith Basin, Fergus county, estimated to cost over two million dollars.

There are now thirteen projects within the state which have elected to come under the new irrigation law and have filed their petitions with the Montana Irrigation Commission, while several others are being formed with a view of coming in this summer and fall. In Broadwater county, near Three Forks, is a proposed project of 3,000 acres which will be irrigated by pumping water by electric power.



DIARY OF AN OLD-FASHIONED FARMER'S WIFE

9:45 a.m. Spank the baby for playing with coal oil lamp.

MORE ELECTRICITY NEEDED ON THE FARM



R. W. Clark, assistant sales manager of the Puget Sound Power and Light Co., Seattle, whose effective work as chairman of the advisory committee is in large part responsible for the enthusiasm with which the new movement is being inaugurated.



J. V. Strange, assistant general manager of the Pacific Power and Light Company, Portland, Ore. Mr. Strange has been one of the strongest members of the committee in laying the plans for a successful Northwest Electric Service League.



Roy C. Kenney, manager of the Portland office of NePage-McKenny and president of the Oregon Contractors and Dealers' Association, which has already pledged its support to the new cooperative movement.



A. C. McMicken, sales manager of the Portland Railway Light and Power Company, who presided over the important meeting of the Northwest Light and Power Association at which plans for the new movement were definitely adopted.

PROGRESS OF THE NORTHWEST ELECTRIC SERVICE LEAGUE

Unquestionably one of the most important events in the electrical industry of the Northwest is the inauguration of the cooperative movement now under way in that district. The preliminary work toward the realization of the plans recently adopted by the Northwest Electric Light and Power Association has already been undertaken. Joint meetings have been held in Portland at which the possibilities of the movement were discussed and the ground prepared for its actual initiation.

A significant aspect of the situation is the unanimous support given this work by the contractors and dealers throughout the Northwest. So much interest was felt in the possibilities of the movement that a delegation from Washington and Oregon attended the Pasadena Convention of last May expressly for the purpose of getting in touch with the California Electrical Cooperative Campaign and of learning from its experiences. The Portland dealers have already expressed their approval of the Service League in the most concrete way by pledging their quota toward its financial support.

The work to date has been in the hands of the Advisory Committee especially appointed by the executive committee of the Northwest Electric Light and Power Association to report on the feasibility of the cooperative movement in the Northwest. To R. W. Clark, as chairman of that committee, must be given the credit for much of the constructive work which has already been done. The other members of the committee, many of whom are pictured on this page, are:

F. N. Averill, Fobes Supply Company, Portland, Oregon
L. A. Lewis, Washington Water Power Company, Spokane, Wash.
W. R. Putnam, Idaho Power Company, Boise, Idaho
R. F. Bailey, Utah Power and Light Co., Salt Lake City, Utah
J. Ryan Gaul, The Montana Power Company, Butte, Montana
J. F. NePage, NePage-McKenny, Seattle, Wash.
W. M. Meacham, Meacham and Babcock, Seattle, Wash.
J. I. Colwell, Western Electric Company, Seattle, Wash.
J. R. Tomlinson, Pierce-Tomlinson Electric Company, Portland, Oregon
Roy C. Kenney, NePage-McKenny Company, Portland, Oregon
A. C. McMicken, Portland Railway Light and Power Co., Portland, Oregon
J. V. Strange, Pacific Power and Light Company, Portland, Oregon
C. B. Hawley, Intermountain Electric Company, Salt Lake City, Utah
H. L. Bargion, Montana Electric Company, Butte, Montana
W. D. McDonald, Westinghouse Electric & Mfg. Company, Seattle, Wash.
R. T. Stafford, Allis-Chalmers Company, Seattle, Wash.
A. S. Moody, General Electric Company, Portland, Oregon



C. B. Hawley, manager of the Intermountain Electric Company of Salt Lake City, brings the Utah cooperative spirit to the wider Northwest movement in which Utah hopes later to take active part.



Lewis A. Lewis, sales manager of the Washington Water Power Co. of Spokane, who has done progressive work in that district in establishing cordial relations between all branches of the industry.



F. N. Averill, manager of the Fobes Supply Company, Portland, Wash. The jobbers and contractor-dealers of Portland have for some time been holding joint meetings in the furthering of their common interest.



J. R. Tomlinson of the Pierce-Tomlinson Electric Company, Portland, who with Mr. Kenney has had much to do with the success of the strong contractor dealers' organization of the Portland district.



A. S. Moody, of the Portland office of the General Electric Company is always back of constructive efforts to better the electrical industry and has taken an active part in the formulation of the plans under way.



H. L. Bargion, manager of the Montana Electric Company. The electrical men of Montana have taken a vital interest in the making of plans and the state counts on entering the list of those who participate in the Service League.



J. I. Colwell, Seattle manager of the Western Electric Company. The jobbers are strongly behind the Northwest campaign in the broadest spirit of cooperation and their support is vital to the success of the movement.



W. D. McDonald of the Westinghouse Electric & Manufacturing Co., Seattle, Seattle and Portland are looked to as the centers from which the new movement will start, from here spreading throughout Oregon and Washington.

Potential Kilowatts and Business

BY JOHN M. MORRIS

(Here is a surprising story of what happens in industry when one kilowatt of hydroelectric power is developed in the West. It shows clearly the vital concern of all branches of the electrical industry in the development of water power. The author is with the Westinghouse Electric & Manufacturing Company of Los Angeles, and presented this paper before the recent meeting of the Pacific Division of the National Electric Supply Jobbers' Association at Del Monte, October 23, 1920.—The Editor.

It would be difficult to conceive of a subject of more vital interest to the whole electrical fraternity of the West—manufacturers, central stations, jobbers and dealers—than that of the relation of hydroelectric development to the resulting demand for electrical apparatus.

Let us first turn to the frontispiece of this issue of the Journal of Electricity and imagine, if you will, a quantity of water equal to about one-half the capacity of the gasoline tank on your automobile, or ten gallons, as being dropped down from the storage above to the water wheel below. You will agree that the quantity appears insignificant from the standpoint of potential power; but let it fall a distance of 600 feet, properly harness it, and a single kilowatt of electric energy has been developed.

A natural question we each might ask is, "What does it mean to me in my business to see that this potential kw. is developed—does it mean much or little, or in fact, does it mean anything to my own particular business?"

First of all, we harness our ten gallons—which means the construction of tunnels, penstocks, a power house, and of course one kw. in generator capacity and one kw. in step-up transformer capacity. It is of interest to note that it costs \$140 to do this and to make 1 kw. available to the transmission line. We might note that of this \$140 approximately 15 per cent, or \$21, is spent for electrical apparatus, the balance going for development of power sites, etc.

It is evident that we must provide at least 1 kw. in transmission line capacity in order to bring this 1 kw. from some power house more or less remote, to the point where it is to be distributed at lower and more convenient voltages. This involves the purchase and construction of towers, the installation of insulators and step-down transformers, amounting to \$70.00.

We now have a good start, having already accounted for 3 kw. in electrical apparatus. We are now ready to distribute this at lower voltages to the points where it is actually to be used.

But, in this distribution step, we must take into consideration the matter of load factor; in other words, for each kw. in generator capacity, more than one kw. in distribution capacity is necessary. We have indicated on our chart that two kw. in distribution capacity is usually installed to take care of one kw. in generating capacity.

Wire and insulators.....	\$27.80
Poles and fixtures.....	21.00
Line transformers.....	24.28
Meters.....	14.20
Sub-station apparatus.....	17.72
Miscellaneous.....	35.00

\$140.00

It costs \$140 in distribution capacity to take care of our 1 kw. in generator capacity, and it is of interest to note what this means in the way of apparatus, as shown in the preceding table.

We are now ready to take up the last step, namely, to consider the apparatus installed in residences, factories and farms, at the points where the electrical energy is actually used.

The ratio of apparatus installed on customers' premises to distribution capacity varies over such a large range that it is difficult to do more than assume a rough figure as representing this ratio in a general way. In the case of industrial plants, this ratio is probably in the neighborhood of $2\frac{1}{2}$ to 1. In residences, this ratio would run perhaps as high as 5 to 1. We have assumed in our chart an average ratio representing all users as being 3 to 1. In other words, we may expect to see 6 kw. in apparatus of all kinds installed on a consumer's premises for every one kw. generating capacity.

On our chart we have indicated the sum of \$750 as representing the cost of purchasing and installing apparatus on customers' premises to take care of 1 kw. in generating capacity.

The following table indicates in a general way how this figure of \$750 was obtained:

Industrial Users, $3\frac{1}{2}$ kw.	Conduit & wiring, including labor, @ \$35 per kw.	\$122.50
	Motors, etc. @ \$20 " "	70.00
		\$192.50
6-kw.		say, \$200.00
	Conduit & wiring, $2\frac{1}{2}$ residences.... @ \$200 " "	\$500.00
	Lamps and appliances, $2\frac{1}{2}$ residences @ \$20 " "	50.00
Residences & Lighting users $2\frac{1}{2}$ -kw.		\$550.00
	Total,	\$750.00

It is estimated that from \$50,000,000 to \$70,000,000 should be invested each year for the development of electric power on the Pacific Coast.

On our chart we have assumed this figure to be \$50,000,000. On this basis we reach the surprising result that this means \$105,000,000 per year to the jobbers and dealers in the sale and installation of apparatus on the premises of the ultimate consumers. Here, then, is a very definite and specific reason for the electrical fraternity as a whole doing everything possible to facilitate this development.



DIARY OF AN OLD-FASHIONED FARMER'S WIFE

10:00 a.m. Scold Miranda for reading when she should be operating hand churn.

MORE ELECTRICITY NEEDED ON THE FARM

Interesting Additions to the Longest Transmission System

BY C. O. POOLE

(World records are always interesting, but the fact that east of the Sierra Nevada Mountains is the longest single transmission hydroelectric energy in the world is of unusual interest in view of the present day emphasis on the transmission of energy over ever-increasing distances. Here is an article describing some of the new additions that are now being made to this system. The author is chief engineer of the Southern Sierras Power Company, the holding company for this system of transmission of world record proportion. The photographs are by W. L. Huber.—The Editor.)



Owens River Gorge, on the eastern slope of the Sierra Nevadas, where the river falls 2200 ft. in a distance of 15 miles.

JUST over the range on the eastern slopes of the Sierra Nevada Mountains lies a country that is little known to the average Californian. In strange contrast with the western slopes of this range, the fall from the summit of the mountains to the valleys below is very precipitous. Across the floor of these valleys, a few miles distant, you ascend another range of mountains, the peaks of which reach an altitude of more than 13,000 feet. Geographically this country seems a

part of Nevada rather than California, and influenced as it is by the near-by Nevada deserts, it differs very much in climatic conditions from the great valleys to the west.

The little village of Lone Pine, nestling at the base of the mountains, lies virtually in the shadow of the highest mountain peak in the United States—Mount Whitney, which is scarcely six miles distant. This steep slope of the range has been taken advantage of in the development of hydroelectric power, and the traveler will notice, stretching through the entire valley, a line of towers supporting conductors which will carry the subtle energy far into the lower elevations. Across blistering deserts and mineral-laden mountains, through the orange groves of Southern California the line goes on, touching the great Imperial Valley, and on over the mysterious sandhills of the Mexican border to the Colorado river. Here California merges into another state, but the line goes on.

Water Sources of Southern System

The principal source of supply for the systems of the Nevada-California Power Company and the Southern Sierras Power Company is found in Inyo and Mono counties, California. The first developments of the companies were the installation of a string of five plants on Bishop Creek, utilizing a fall of 3400 feet in this stream. The growth of the business of these companies demands the bringing in of a hydro plant practically every year and, in keeping with this practice, there are at the present time two developments in course of construction, some features of which may be of general interest.

The Southern Sierras Power Company owns in fee-simple a mile of Owens river stream bed in what is known as the Owens River Gorge, located fifteen miles north of the town of Bishop. This location is on the same parallel as Merced on the western slope. The shrinking of the volcanic plateau formed a great fissure in the earth, through which the river is now flowing. The banks are six hundred feet above the stream for a distance north and south of fifteen miles, and in this distance the river falls 2200 feet. The average flow of the stream will be a little more than 300 second-feet. The mile of river owned by the Southern Sierras Power Company has a drop of 421 feet, and work is under way for the complete development of this part of the stream.

An Auxiliary Power Plant

In order to relieve, at least in a measure, the present power shortage, this company is now nearing the completion of a 2500-kw. plant on the river, utilizing 143 feet of the fall of the stream. This development was decided upon for the reason that it could be put into service in a very much shorter time



The Bishop Creek Control Station of the Nevada-California Power Company where is installed the largest transformer west of the Rockies,—all the power supplied to the entire system passing through it.

than it would take to drive the long tunnel for the complete development. When the main plant is installed, the present plant (which is called the auxiliary plant) will be retained to utilize the stream flow during the heavy run-off period. This plant is designed to use 350 second-feet of water, while the river runs as high as 900 second-feet during some seasons. After the main plant is completed to utilize the 421-foot head, the auxiliary plant will be made automatic, or remote controlled from the main plant.

The auxiliary plant now being constructed gets its water from the stream by means of a concrete overflow diverting dam in the river bed, turning the water into a wooden flume twelve feet wide and sides five feet high, for a distance of 363 feet, where it connects to a large gate and screen box. From this point a flume eight feet wide by seven feet high carries the water a farther distance of 510 feet, where the flume connects with a concrete screen box that also serves for an intake for the penstock.

The penstock consists of a 66-inch diameter riveted steel pipe line 650 feet long, which terminates in the power house, connecting to a butterfly valve which controls the water entering the turbine. The turbine is a horizontal double-discharge Pelton unit direct-connected to a Westinghouse 3000-kva., 6600-volt, three-phase, 514 r.p.m. generator with direct-connected exciter.

The current generated at 5600 volts will be carried on a line down the canyon 3400 feet to a bank of transformers now being installed at the site of the main plant. This transformer bank consists of three 3500-kw. units, stepping up from 6600 volts to 88,000 volts delta, or 155,000 volts star. This bank will take care of both the main plant and the auxiliary plant.

The power house of the auxiliary plant is a solid concrete structure 32 ft. by 54 ft., of pleasing appearance, and is provided with a twenty-ton traveling crane for handling the equipment.

The main plant, when completed, will have a capacity of 7500 kw. in one unit. There will be a tunnel 4700 feet long and 10 ft. by 12 ft. in dimensions, to which will be connected a 66-inch pressure line 900 feet in length. The combined capacity of the two plants will be 10,000 kw.

The upper end of the steel tower line before referred to terminates at Bishop Creek, at which point all the other lines in that locality converge. The switching station at this point is called the Control Station, as the plants and lines are controlled from that point. Extending north from the Control Station into Mono county a distance of sixty-four miles is a circuit of 4/0 aluminum-steel conductor supported on "H" frame wooden poles. This line is insulated for 150,000 volts and serves as an artery for the hydro plants in the Mono Basin.

A Development at High Altitude

To supplement the present plants in that locality there is under construction at the present time a 10,000-kw. plant known as the company's "Leevining Creek Number One." This plant will be fed from the snow fields of Mt. Conness and Mt. Dana. These mountains contain two of the largest glaciers in the range. An interesting feature of this development is the altitude at which the work is carried on.

The principal storage of the development is what is known as Saddlebag Lake, which is located on one of the branches of Leevining Creek at an elevation of 10,050 feet. The ultimate capacity of this reservoir will be 18,000 acre-feet. The dam is a rock-fill timber-face structure, the ultimate height of which will be fifty-seven feet above lake level. The

length of the dam at the crest will be 700 feet. There is a cut into the lake which will lower the present water level 12 feet, giving 2,000 acre-feet additional storage. The drainage area back of this reservoir is not sufficient to fill it when the dam is carried to the ultimate height, therefore additional branches of the creek will be diverted into the storage basin by means of canals and tunnels. A drop of 350 feet between this reservoir and the main stream below will be utilized by the installation of a 1000-kw. automatic plant.

The water after leaving this plant will flow down the natural channel of the stream for a distance of two and one-half miles, into Rhinedollar Reservoir, a combined storage and intake pond which lies on the very edge of a precipice at an elevation of 9,600 feet. From this intake reservoir the water will be conducted through a pipe 48 inches in diameter, a distance of 600 feet, which will connect to a rock tunnel 2200 feet in length. From the tunnel the water



Diversion dam and intake for the Adams plant of the Southern Sierras Power Company

reaches the power house through a steel pipe varying in diameter from 40 inches to 32 inches, having a length of 3600 feet, giving a fall of 1670 feet in a total of 6400 feet of conduit.

The plant is designed to use 100 second-feet of water driving a single over-hung, impulse type water wheel with a generating unit of 12,500-kva. capacity, at 6600 volts. Outdoor transformers will step the voltage up to 150,000 volts, feeding into the transmission system connecting with Control Station on Bishop Creek. This is one more link in the rapidly growing system of the company.

It is certainly an inspiration, even to an engineer, to stand on Saddlebag Dam and let his thoughts follow the waters over 500 miles—from the melting snow down through its many changing forms of energy; from the turning of the water wheel near-by



DIARY OF AN OLD-FASHIONED FARMER'S WIFE

10:10 a.m. Wash one dozen sheets, not to mention other family wash.

MORE ELECTRICITY NEEDED ON THE FARM

to the transformation of the desert lands into orange groves, and turning of the muddy waters of the Colorado into crystal ice in the great Imperial Valley. Thus, ice returns to ice.

MOTORS FOR THE FARM

(The farmer will be happy enough to lighten his chores through the use of the electric motor if the electrical man will present the motor and tell him how, when and where to use it. This is a short summary of the farm machines which can be run by motors, complete equipment for the barn, dairy and residence being given.—The Editor.)

For the benefit of those who have occasion to handle motors in towns in farming communities the following table and remarks which were prepared by the Westinghouse Electric & Manufacturing Company will prove of the greatest value. The farmer whose farm is located near the transmission or distribution lines of a power company can easily be shown the applications of electricity and the subsequent savings in dollars and cents. To the farmer who is in the market for a farm lighting set this table should be shown so that he will not think that the only thing that electricity can do for him is to light his house and barn.

MACHINE	MOTOR HORSEPOWER		Size Most Used
	Minimum	Maximum	
Feed grinders (small).....	3	10	5
Feed grinders (large)	10	30	15
Ensilage cutters	10	25	15-20
Shredders and huskers.....	10	20	15
Threshers, 19-in. cylinder.....	12	18	15
Threshers, 32-in. cylinder.....	30	50	40
Corn shellers, single hole.....	3/4	1 1/2	1
Pcwer shellers	10	15	15
Fanning mills .....	.....	.....	1/4
Grain grinders .....	.....	.....	1/4
Grain elevators	1 1/2	5	3
Concrete mixers	2	10	5
Groomers (vacuum system)	1	3	2
Groomers (revolving)	1	2	1
Hay hoists	3	15	5
Root cutters	1	5	2
Cord wood saws	3	10	5
Wood splitters	1	4	2
Hay balers	3	25	7 1/2
Oat crushers	2	10	5
Cider mills	2	5	2 1/2
Clover cutters	1/4	1 1/2	1 1/2
Water pumps	1/2	5	3
Cream Separators	1/10	1/4	3/8
Butter churns	1/8	3	1/4
Milking machines	3	5	5
Bottle washers	1/8	3/4	1/2
Vacuum system	2	3	3
Refrigeration	1/2	25	3-5
Grindstones	1/8	1 1/4	1/4
Emery wheels	1/4	1	1/4
Lathes	1/4	1 1/2	1/2
Forge blowers	1/15	1/8	1/10

HOUSEHOLD MACHINES			
Sewing machines	1/40	1/30	1/30
Buffers and grinders	1/40	1/30	1/30
Portable vacuum cleaners	1/83	1/45	1/83
Large ice cream freezers.....	1/8	1/4	1/8
Washing machines	1/8	2	1/8 to 1/4
Centrifugal dryers	1	2	1
Mangles	1/4	1	1/2
Meat grinders	1/4	3/4	1/4
Sausage stuffers	1/2	1	1/2
Water pumps	1/4	1	1/2
Meat grinders	1/4	3/4	1/4
Sausage stuffers	1/2	1	1/2

This table includes more electrically-driven farm machinery than is found on the average farm. On a well-equipped average-sized dairying, mixed farming, and small stock raising farm, say of 100 to 150 acres, the following machinery will probably be found:

Barn Equipment (heavy duty): Corn sheller, feed grinder, fodder and ensilage cutters, hay hoist, hay press and baler, threshing machine, cider press, wood splitter, and sawing machine, all of which are

heavy duty machines required at different times of the season, so that a single motor large enough to do the heaviest duty, mounted on a skid or truck, will do all the work and keep the investment at a minimum. A 10-horsepower motor with its overload capacity will perform work equivalent to a 15-horsepower gasoline engine.

Barn Equipment (light duty): Grindstones, emery wheels, bone grinders, etc. These are usually located in a repair shop and can be driven by a small motor connected to a shaft. Water pump, spraying machine, fanning mill, milking machines, and groomer should have individual drive.

Dairy Building Equipment: Milk cooling pump, cream separator, churns, butter worker, and refrigeration system can all be driven from countershaft with a motor of sufficient capacity to run any two machines on full load at the same time, or by individual drive if preferred.

Residence Equipment: Meat grinder, sausage stuffer, ice cream freezer, washing machine, and mangle can be arranged for driving by one motor connected to countershaft, the motor to be large enough to run the largest machine fully loaded. Vacuum cleaner, sewing machine, buffer and grinder, and residence water pump should have individual motors either belted or direct connected.

On farms raising considerable poultry, electricity can be used to good advantage for heating brooders and incubators. Often, too, the farmer finds it of advantage to employ electric trucks, if he is on the line of the local power company. He can charge these trucks himself by installing a battery-charging set with switchboard. An electric motor mounted on skids or a truck will do many of the barnyard chores in a small fraction of the time it takes to do them by hand.

And so it is all down the line; sort out the different kinds of work that have to be done on the farm and it will readily be seen that these items can be disposed of by means of relatively small motors. An advantage in driving barn and field machinery by electric motors is the fact that the power is instantly available. The motors required are light in weight and can therefore be installed without special foundations.

FARM POWER REQUIRED

The total amount of power required for farm operations is surprisingly large. Unfortunately there are no authentic figures available giving the total number of prime movers used in agriculture, but the following recently compiled table gives interesting estimates:

	Number	Horsepower
Horses	21,040,000	14,026,000
Mules	4,123,000	2,748,000
Steam engines	200,000	6,000,000
Gas tractors	300,000	7,500,000
Automobiles	2,000,000	30,000,000
Gas engines	1,000,000	2,000,000
Windmills	1,600,000	60,000
Total.....		62,334,000

There might be some objection to including the automobile in the foregoing classification, but it is recognized as standard equipment on many farms and should be included to make the story complete.

A Common-Sense Hydro-Electric Plant

BY ROSS L. MAHON

(No one wants to leave the convenience made possible by electric power, even during the summer months, and for this reason the summer resort manager must devise some means of establishing the home electrical in the most out-of-the-way corner of the woods or mountains. An engineer with the Pelton Water Wheel Company tells here of the highly successful installation of a hydroelectric plant for the use of the Feather River Inn.—The Editor.)

The wide publicity which has been given, of late, to the development of some of the country's larger and more important water power projects, has undoubtedly impressed engineers, as well as the general public, with the sound, practical, common-sense nature of such undertakings. There is now no doubt but that the country, and particularly the West, looks to these larger developments for the solution of many of its power problems.

At the same time, the magnitude of these large projects and the immense investments involved should not cause us to forget or overlook the fact that there are many thousands of horsepower available from small streams, the amount of power developed by a single water wheel installation being comparatively little.

So, for fear that the small hydroelectric power plant with its great field of usefulness, be lost "in the shuffle," this short article has been written for the express purpose of showing what can be done throughout the mountainous regions of our Western states, in developing and utilizing small and apparently inconsequential streams in such a way as to result in the production of considerable power. The Western states are referred to particularly, as it is within their boundaries that comparatively high heads can often be obtained at least expense, and many of the mining and summer resort localities have not yet been reached by the transmission lines of the large hydroelectric power companies.

Demand for Power in Remote Places —

In this region, just as elsewhere in the civilized world, electrical energy becomes a more and more important factor in every-day life. Small mountain towns and settlements must have lights for their streets and dwellings; mines must have power for their drills and hoists; and summer resorts must be able to provide their patrons with dependable service for lights, power and heat. In fact, the hotel guest will even expect better service than he sometimes enjoys at home, and the hotel or summer resort manager who does not realize this fact is rare indeed.

In past years, when people situated in this way finally realized the need for power, they have made

use of some kind of fuel for its development. Wood, coal, and crude oil have all been used extensively in operating steam plants, and of course the modern gas engine, using some one of the refined products from crude oil, is now a very common and dependable source of power. But the days of cheap fuel are past. Lumber prices have risen to such an extent that a number of saw-mills cannot now afford to burn material previously used under their boilers. The country's coal supply becomes less each year, and its cost is increasing; the oil situation becomes more serious as time passes, with a constantly diminishing supply, increasing price, and actual scarcity occurring in states where it is taken from the ground

and refined. Why, then, is it not logical to look for a source of power which requires no fuel, and thus becomes cheaper from year to year when we compare it with wood, coal, and oil?

The answer is water power, which is coming into more general use as the public becomes educated to its possibilities, and the man living in the mountains realizes that the common sense method of producing light, power and heat, even in very small amounts, actually lies at his own back door, in the form of

a small, swiftly running, precipitous mountain stream. A properly designed water wheel, with its pipe-line and dam will transform the small stream into a power producer rivaling the gas or steam engine for dependability, and excelling them greatly in efficiency.

It is true that our modern summer resorts and hotels, located in the mountains of California, Oregon and Washington, have become an institution, as they are the summer playground for the city dweller and his family, all of whom are accustomed to depend almost entirely on electrical energy for their lights, power and heat.



A view of the upstream face of the timber crib dam which was constructed to make a storage reservoir for use in generating the power for Feather River Inn, Plumas county, California.



DIARY OF AN OLD-FASHIONED FARMER'S WIFE

12:00 m. John late for lunch, mending windmill, out of order on first windy day for month.

MORE ELECTRICITY NEEDED ON THE FARM

Small Plant for a Summer Resort —

One of the most modern summer hostleries in California is located near Blairsden, Plumas county, California, on the Middle Fork of the Feather River. Opened in the summer of 1915, it depended at that time, for its light and power, on two gasoline engine driven electric generators, delivering 240-volt alternating current into the lines which served the main hotel building, as well as the hotel grounds and a large number of chalets or smaller cottages and tent houses with electricity. In order to keep this power plant in operation for about three and one-half months of the summer during June, July, August and September, it was necessary to ship in, each season, several carloads of gasoline and distillate. This was delivered by freight, over the main line of the Western Pacific Railroad to Blairsden, in steel drum containers, from which point a mile and a half haul by team was necessary in order to get the fuel to the power plant.

This plant was operated for some five years until, in the summer of 1919, an investigation was made of water power possibilities. A small stream, tributary to the Feather River and flowing through the hotel property, had previously been considered only large enough for supplying the domestic water system of the hotel, and accurate weir measurements made in September showed that during this driest period, the flow of water in it mounted to some 38 cubic feet per minute. This stream received its supply from springs and the flow varied very little throughout the summer season. In addition to this, 1919 was an exceptionally dry year, particularly in California.

A study of the ground indicated that at a distance of a little over three-quarters of a mile up the stream from the hotel, there existed an ideal site for a small storage reservoir, providing a dam of suitable size were built. A pipe-line or penstock, leading from this dam, along the side-hill of the small canyon, and then down a shoulder of the mountain to the hotel, would be able to deliver pressure water at the power plant under a static head of over 500 ft. The total connected load on the existing gasoline engine driven plant was then checked up, and it was found that a water wheel capable of delivering about 55 max. hp. to its electric generator, would be of sufficient capacity to take care of peak load conditions, which existed during the evenings.

New Plant for Feather River Inn —

The officials of the Feather River Inn then reached a decision to install the new hydroelectric equipment, as it was very evident that by doing so they would be able to make it pay for itself within three or four years' time.

The entire development consisted of storage reservoir, dam, pressure penstock, and the water wheel driven generator. No new switchboard equipment was required, as the outfit already in use with the gasoline engines was available. The necessity for water storage, however, was very apparent, as the minimum flow of the stream, some 38 cubic feet per minute, when delivered to the water wheel under

about 470 feet effective head at the nozzle, all pipe friction losses deducted, would develop only 27 horsepower off the water wheel shaft. The characteristic load curve of the power plant indicated, however, that with practically no load from 11 p.m. until 7 a.m., and a very light load through the morning and afternoon, sufficient water could be stored to carry the heavy load through the evening. This made necessary the construction of a storage reservoir which would allow between 25 and 30 cubic feet of water per minute to accumulate during about 18 hours out of every 24, or a capacity of some 22,000 cubic feet, together with a closed pressure pipe from the dam down to the power plant. It is obvious that a flume or ditch, bringing the water from the dam to a forebay or pressure box at the pipe-line intake, would not have served the purpose, as it would have been impossible to obtain a storage capacity of 22,000 cubic feet elsewhere than in the bed of the stream, at any reasonable cost.

Storage Dam —

This is of the usual timber crib rock fill type. The bedrock of the stream bed was first stripped clean and the sides of the small canyon blasted out for the abutments of the dam. Rock and earth, taken from the stream bed and from the side-hills above the abutments of the dam, were used as a filler, after the timber crib work had been completed.



Timber crib dam showing location of sluice gate and headgate

A sluice-way pierces the dam at its lowest point, and is closed at the upper end by means of a wooden sluiceway, with a steel pipe or spindle op-

erated by the usual floor stand, threaded bronze nut, and handwheel, located on a special platform extending from the upstream face of the dam.

The pipe-line also passes through the lower part of the dam, and has its intake in a riveted steel taper, having a special cast iron headgate. This headgate is, like the sluiceway, operated by means of a handwheel, located on the platform above it.

Pressure Pipe-Line or Penstock —

From the dam a pressure pipe-line, constructed entirely of riveted steel, carries the water down to the power plant. The length of this penstock, which is under pressure throughout the entire distance, is about 4300 feet, and the difference in elevation between the level of the water in the reservoir, when full, and the nozzle of the water wheel, is 522 feet.

The intake taper section at the upper end of the pipe-line is 15 inches in diameter at the large or inlet end where it connects to the headgate. To it is attached a vertical air inlet standpipe, 3 inches in diameter and rising to a point slightly higher than the top of the dam. In case the headgate is closed, this pipe provides a means of admitting air to the

pipe-line, thus preventing the formation of a vacuum in it, with the possibility of a collapse due to external pressure.

The pipe-line is buried about 24 inches beneath the surface of the ground wherever possible, and at those points where it crosses small depressions, earth embankments, with stone or timber retaining walls, have been built.

Down near the power house a special flanged, cast iron tee has been introduced, to which is connected a special 4-inch diameter flanged gatevalve. This serves as a cross connection between the high pressure pipe-line of the hydroelectric plant and the domestic water supply system of the Inn, thus admitting the high pressure water into the lines in case of fire. The 4-inch gatevalve has a bronze disc and seat, in order to eliminate all possible chance of sticking or binding, under emergency conditions.

Power House —

At the lower end of the pipe-line, and within 80 yards of the Inn itself, is the new power house, built to take care of the new hydroelectric unit, as well as the gas engine driven generator, which was retained for standby purposes. The building is about 20 feet wide by 30 feet long, and of frame construction, being well lighted by means of several large casement windows. The general design is artistic and quite in keeping with the appearance of the other buildings which are grouped about the main building, or Inn proper. Heavy concrete foundations have been provided for both of the power units, and the entire interior of the power house has been carefully sealed and varnished. The tailrace for the water wheel unit has been excavated beneath the floor of the power house, and it carries the discharge water from the wheel out under the lawn into a large concrete lined swimming pool.

Hydroelectric Unit —

The pipe-line, coming into the power house beneath the floor line, is connected by means of a 45-degree elbow to the main inlet gatevalve of the water wheel unit. This is a specially designed impulse wheel, built by the Pelton Water Wheel Company for this installation, and direct-connected by means of a flexible coupling to an alternating current generator furnished by the General Electric Company.

This wheel is capable of developing 55 maximum horsepower at 1200 revolutions per minute, and the generator is rated at $37\frac{1}{2}$ kva., 80% p. f., 240 volts, 3-phase, 60-cycle, and is equipped with a direct-connected exciter. The general construction of the complete unit is very well shown in one of the photographs.

The wheel itself, or runner, has detachable, phosphor bronze buckets, to which the water is delivered through a single, hand operated needle nozzle. Knowing the normal load requirements for the plant over a 24-hour period, the operator can, from time to time, adjust the nozzle, by means of a hand-wheel, in such a way as to discharge upon the wheel, exactly as much water as is necessary. This allows the water, which is saved by these nozzle adjustments,

to accumulate in the storage reservoir at the intake of the pipe-line, thus making it available for use during periods of heavy load.

All bearings are of the ring-oiling type and an automatic governor has been provided by the water wheel builder, for the purpose of enabling the unit



Shop view of the direct-connected Pelton water wheel and the generator unit

to maintain constant speed and voltage, under fluctuating loads. This governor is of a special type, operated by pressure oil, and a flywheel mounted upon the water wheel shaft, assists and stabilizes its action. The governor operates a deflector within the wheel housing, which in case of a sudden reduction in load, cuts into the jet between the nozzle and the buckets of the wheel and deflects as much of it as necessary, into the tailrace.

All of the water wheel equipment, with the governor and the generator, were assembled upon a rigid cast iron bedplate in the works of the water wheel builder, before being shipped up to the power plant.

A DEMONSTRATION KITCHEN.



A steady sale of electric ranges is the recompense of the Electrical Supply Company, Wenatchee, Washington, for maintaining this perfectly equipped electrical kitchen which is often the scene of cooking demonstrations.



DIARY OF AN OLD-FASHIONED FARMER'S WIFE

1:30 p.m. Iron last week's wash, walking 8 ft. with each iron.

MORE ELECTRICITY NEEDED ON THE FARM

Electromagnetic Calculation

BY H. H. BLISS

(The electric door-bell you use every day is an application of a common type of electromagnet. The following article, the ninth of a series, continues the discussion of the principles of electromagnetism introduced in the previous article. The author is on the staff of the Riverside Junior College, Riverside, California.—The Editor.)

Shapes of Magnets.—Electromagnets in the form of bars are seldom used, a much more common type being shaped somewhat like a horseshoe and presenting two pole faces to the "armature." This last is a piece of iron attracted to the magnet by the magnetic flux (Fig. A). The word "armature" is also given to the mass of iron supporting the copper inductors close to the poles of a generator or motor.

The winding in Fig. A is put upon the poles in such a way that one free end is N and the other S; the flux produced by the current in the coils runs through one pole piece, then the "yoke" connecting the poles, then the other pole, crosses one "air gap," runs through the armature, and finally crosses the other air gap to the first pole.

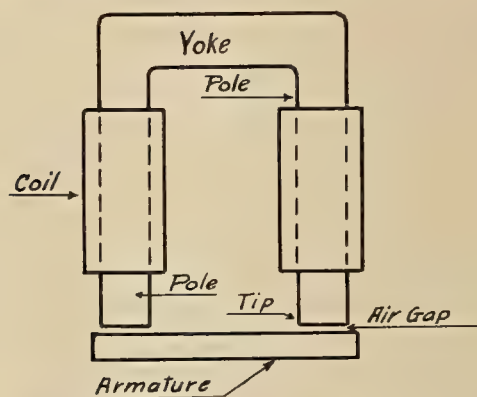


Fig. A. Diagram showing a horseshoe shaped magnet and its armature. The winding is put upon the poles in such a way that one free end is N and the other S.

In Fig. B is shown a typical application of the electromagnet of horseshoe shape, the electric door-bell. Current entering at binding post A energizes the magnet and passes through the clapper arm B to point C and so to the binding post D. The armature is drawn toward the magnet and the clapper strikes the gong, while contact at C is opened, thus stopping the current. A spring throws the clapper back to its first position and the operation begins again.

Ampere-turns and Permeability.—When a coil carrying current is filled with an iron core the flux is always very much greater than with a core of wood or brass or air. This effect is said to be due to the multiplying power or "permeability" of the iron. A doughnut-shaped coil, with sufficient ampere-turns to give 200 lines of force without iron, may produce 200,000 lines if the annular space is filled with wrought iron. Here the permeability is 1000, since it carries 1000 times as much flux as would be present otherwise.

The permeability is different for each grade of iron or steel, and it varies also with the flux present in any given sample. Cast steel, for instance, has a permeability of about 1100 with a "flux density" (number of lines per sq. in. of cross section) of

50,000, but its permeability is only 300 when the flux density is 100,000 lines per sq. in.

While the flux for a ring-shaped coil with a core of air (or of anything else except iron or steel) is given by the formula:

$$\text{Flux} = \text{area} \times 3.2 \times \text{ampere-turns/length},$$

when there is an iron core the formula becomes:

$$\text{Flux} = \text{area} \times 3.2 \times \text{permeability} \times \text{ampere-turns/length}.$$

If we divide both sides of the equation by the cross-section area, we have on the left side **flux/area**, which is the same as the **flux density**, and we have the formula in another form:

$$\text{Flux density} = 3.2 \times \text{permeability} \times \text{ampere-turns per inch (since ampere-turns/length is the same as ampere-turns per inch of length)}.$$

Finally, we divide the $3.2 \times \text{permeability}$ into the other side of the equation, obtaining:

$$\text{Flux density} \div (3.2 \times \text{permeability}) = \text{ampere-turns per inch}.$$

Examples.—How many ampere-turns are necessary to drive 150,000 lines for one inch through a piece of cast iron 3 sq. in. in cross section, the permeability being 110? What if the metal is replaced with wrought iron whose permeability = 1700? $\text{Flux density} = 150,000/3 = 50,000$ lines per sq. in.; $50,000/(3.2 \times 110) = 142$ ampere-turns per inch for cast iron; $50,000/(3.2 \times 1700) = 9.2$ for wrought iron.

If a cast iron electromagnet of horseshoe shape (Fig. A) has a flux of 150,000, cross-section of 3

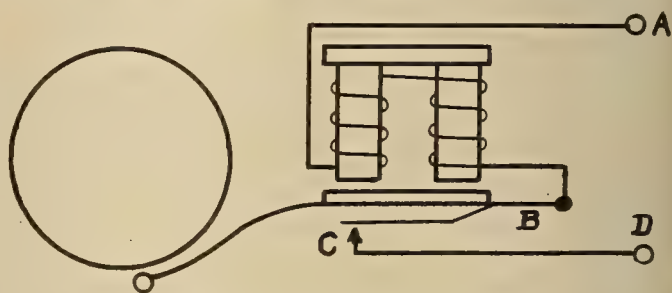


Fig. B. Diagram showing the application of the horseshoe shaped magnet in the operation of the electric bell.

sq. in., and a total magnetic length of 20 in., and if its wrought iron armature (in which the lines run for 7 in.) has a cross section of 2 sq. in. and a permeability of 1470, how many ampere-turns are required, on the assumption that the armature is in such close contact with the pole-tips that there are no "air gaps"? To drive the flux 20 in. through the cast iron takes $20 \times 142 = 2840$ ampere-turns; for 1 in. in the wrought iron it takes $75,000/(3.2 \times 1470) = 16$, and for 7 in. $7 \times 16 = 112$. Total = $1470 + 112 = 1582$ ampere-turns.

How many additional ampere-turns would be needed if the armature were $1/8$ -in. from the pole

faces? The permeability of air (as of practically all materials except iron and steel) being **one**, and the flux density being the same as in the pole faces, we have $50,000/3.2 = 15,600$ ampere-turns per in. Total length of air gaps = .25 in., hence they require $.25 \times 15,600 = 3900$ ampere-turns. The total then would be $3900 + 1582 = 5,482$ ampere-turns.

It is found in practice that in such cases as this many lines of force escape from the N pole of the magnet and get to the S pole through the air instead of going to the armature. They are then, of course, useless as far as pulling on the armature is concerned. This often makes it necessary to figure on from 1.2 to 1.5 times as much flux in the poles and yoke as in the air gaps and armature.

Table of Ampere-Turns.—For purposes of computing ampere-turns, etc., one must take into consideration the permeability of irons and steels under various conditions of flux density. The table below gives the data in the most convenient form, namely, the ampere-turns per inch of magnetic length for different flux densities. It was worked up by the use of the "ampere-turn formula" from the results of experiments on permeability. For instance, the permeability of sheet steel at 100,000 lines per sq. in. was shown by test to be 390; ampere-turns per inch = $\text{density}/(3.2 \times \text{permeability}) = 100,000/(3.2 \times 390) = 80$.

AMPERE-TURNS PER INCH

Flux Density	Air	Cast Iron	Wrought Iron	Cast Steel	Sheet Steel
30000	9400	40			
40000	12500	80			
50000	15600	140	9	14	6
60000	18800		10	16	7
70000	20900		13	20	10
80000	25000		18	28	16
90000	28100		30	43	32
100000	31200		70	103	80
110000	34400				177
120000	37500				360

Pull of a Magnet.—It is found that the pull of **one pole** of a magnet upon the armature may be accurately expressed by the following formula:

$\text{Pull} \times 72,000,000 = \text{area} \times \text{density} \times \text{density}$, where the pull is in pounds, the "area" being the area of the pole face in sq. in., and the density being the flux per sq. in.

For example, find the total pull upon the armature of a horseshoe magnet with a flux of 26,500 lines, the poles being circular and $\frac{3}{4}$ in. in diameter. Here the area = $.785 \times .75 \times .75 = .442$ sq. in.; density = $26,500/.442 = 60,000$. Then the pull = $.442 \times 60,000 \times 60,000/72,000,000 = 22.1$ lbs. for one pole or 44.2 lbs. for both.

Answers to First Magnet Problems

87. Resistance of each coil = 210 ohms. Current = $130/420 = .31$ ampere; $.31 \times 700 = 217$ ampere-turns.

88. Ampere-turns per coil = $350 \times 80/210 = 133.3$. Total = 267 ampere-turns. Lifting force will be only a trifle over 55 lbs., since the magnet was saturated with the smaller number of ampere-turns.

89. In Problem 87, power = 40.3 watts = .0403 kw-hr. per hour, or $3412 \times .0403 = 137.6$ B.t.u. per hr. In Problem 88, power = 61 watts, giving 208 B.t.u. per hr.

90. Periphery = $3.14 \times 5.5 = 17.3$ in. Area = $7.8 \times 17.3 = 135$ sq. in., allowing 67.5 watts at .5 watt per sq. in.

91. Amperes \times amperes \times ohms = 67.5; amperes \times amperes = $67.5/30 = 2.25$; amperes = sq. root of 2.25 = 1.5. Then volts = $1.5 \times 30 = 45$.

92. We must have $2.5 \times 600 = 1500$ ampere-turns to get the required flux. Then with 820 turns the current must be $1500/820 = 1.83$ amperes. $1.83 \times 14 = 25.6$ volts.

93. $120/3 = 40$ ohms, resistance of coil. $40/2 = 200$ turns of wire. $3 \times 200 = 600$ ampere-turns. $120 \times 3 = 360$ watts = .36 kw. $.36 \times 3412 = 1228$ B.t.u.

94. Heating 800 cu. ft. 1° takes $.02 \times 800 = 16$ B.t.u.; for 15° it takes $15 \times 16 = 240$ B.t.u. In 1 hr. the heat developed = $240 \times 60 = 14,400$ B.t.u., corresponding to $14,400/3412 = 4.22$ kw-hr. per hr. The power is then 4.22 kw.

95. Cylindrical surface = $160/8 = 200$ sq. in. Periphery = $200/7.4 = 27$ in. Diameter = $27/3.14 = 8.6$ in.

96. Area = $.75 \times .75 \times .7854 = .442$ sq. in. Ampere-turns = $67 \times 12/(3.2 \times .442) = 568$; current = $568/150 = 3.8$ amperes.

97. Flux = $3.2 \times 13 \times 620 \times 10/30 = 8,600$ lines. Wood and brass would not change the flux at all; with an iron core there would be many times as many lines as with an air core.

Second Set of Magnet Problems

98. From the table of "Ampere-turns per inch" determine the permeability of cast iron at density = 40,000; of the other three metals at density = 70,000.

99. "Interpolate" in the table to find the ampere-turns per inch for cast iron at density = 35,000, for cast steel at density = 88,000, for sheet steel at density = 92,000.

100. Find ampere-turns necessary for a horseshoe electromagnet of sheet steel with a cast steel armature .025 in. away from the pole ends. The flux across the air gaps must be 45,000 lines; the cross section of the armature is .5 sq. in. and its length is 3 in.; flux travels 8 in. in the magnet, which has a cross section of .7 sq. in. There is so much leakage that it is necessary to provide for 1.55 times as many lines in the magnet as across the air gaps; in other words, the "leakage coefficient" is 1.55.

101. How strong is the attraction between a straight bar electromagnet and its armature with a flux of 78,500 lines, the diameter of the magnet being 1.4 in.?

102. What is the pull of this magnet, with the same total flux, if the edge is beveled off so that the diameter of the pole face becomes 1.1 in.?

103. A magnet has two wrought iron pole pieces each 10 in. long and 2 in. in diameter, connected by a cast iron yoke 6 in. long and 7.14 sq. in. in cross section. The armature, of wrought iron, 1 in. \times 3 in., is .015 in. from the pole tips, and the flux is 250,000. Find total ampere-turns if there is no leakage.

104. Work Problem 103 assuming leakage coefficient = 1.14.

105. A horseshoe magnet with cross section $.75 \times .9$ in. must lift a total of 30 lbs. Find density and total flux required.

106. The armature of the above magnet is of cast steel, .27 sq. in. in cross section and 4 in. long (between centers of poles). Each air gap is .01 in. long. What ampere-turns are required for the gaps and armature?

107. This magnet itself is of cast iron, and the magnetic length is 13 in. What is the "leakage coefficient" if it is necessary to send 10 amperes through the 273 turns of the winding to get the pull of 30 lbs.?

108. A magnetic circuit consists of 7 in. of cast iron of cross section 2.10×2.38 in.; 6 in. of sheet steel 1.25×1.60 in.; 15 in. of cast steel 1.47×1.70 in.; and one air gap 1.47×1.70 in. which is .03 in. long. What total flux is set up by 2.5 amperes in 884 turns of wire, if there is no leakage? (Solve by "trial and error"—guess at the answer and compute the necessary ampere-turns.)



DIARY OF AN OLD-FASHIONED FARMER'S WIFE

1:45 p.m. John Jr. gives up fishing to saw wood.

MORE ELECTRICITY NEEDED ON THE FARM

Pamphlets and Clippings in a Business Library

BY VIRGINIA FAIRFAX

(Business facts come into an office from innumerable miscellaneous sources, and unless properly handled, are lost to the organization. Some channels through which useful material may be obtained are here taken up in part two of the third article of a series by the librarian for the Carnation Milk Products Company, Chicago. Permission to reprint must be secured from Journal of Electricity.—The Editor.)

SOURCES FROM WHICH MATERIAL IS SECURED—II.

Miscellaneous Sources

The Pan-American Union, Washington, D. C., is a valuable source for information pertaining to Mexico, Central and South America. Besides its monthly magazine it publishes bulletins and maps which include information necessary in trading and traveling in these countries. The Union has also published a helpful "Reference List of Commerce, Exporting and Importing," giving a bibliography of books, pamphlets, magazine articles, and commercial magazines of South American countries.

The Philadelphia Commercial Museum, Philadelphia, Pa., is a great trade promoting agency. Its foreign trade information service ranks only second to that of the Bureau of Foreign and Domestic Commerce.

The American Express Company, 65 Broadway, New York City, issues in bulletin form, information that is worth while and is another source for business facts.

The Federal Trade Information Service, business office, 175 Fifth Avenue, New York City, publishes a daily bulletin and states that "The purpose of this service is to make available immediately, with interpretative matter, the important information of the Federal Government affecting various departments of corporations; banks and their clients; commercial organizations and their members." It is also an excellent source for noting government information which is issued in pamphlet form, notices of which usually appear in this service more promptly than elsewhere.

Standard Statistics Company, 47 West Street, New York City, issues a daily service similar to the Federal Trade Information Service but broader in scope. Its service is not confined to the Federal Government but aims to cover all basic information affecting trade and industry.

The Investors' Book of Booklets, published monthly by Rudolph Guenther-Russell Law, Inc., 25 Broad Street, New York City, \$2.00 per year, includes a list of booklets and circulars issued from time to time by the leading financial houses of the country, setting forth the conditions and prospects of investments in individual companies, industrials, railroads and public utilities. As the status of such literature is constantly changing, the value of the Investors' Book of Booklets depends entirely upon its being promptly used.

The Publishers' Weekly, published by R. R. Bowker Company, 62 West 45th Street, New York

City, in its weekly record of new publications lists in small type at the bottom of each page the authors and titles of new pamphlets on a variety of subjects with the address of the publisher and the price.

The Corporation Journal, published monthly except in July and August by the Corporation Trust Company, 37 Wall Street, New York City, "furnishes corporation attorneys and others interested, a brief account of current happenings, of recent court decisions, new laws, etc." The company also publishes other pamphlets relative to corporation laws in various states which, in addition to the Journal, are sent without charge.

The Public Affairs Information Service, published by The H. W. Wilson Company, 958 University Avenue, New York City, is a valuable subject index to "all kinds of publications—books, pamphlets, government documents, proceedings of associations and even unpublished manuscript, as well as many periodical articles." It may be subscribed for as a weekly or bi-monthly cumulative service according to the needs of the business organization.

The Industrial Arts Index and the Agricultural Index, which are issued monthly by The H. W. Wilson Company, not only index under subjects articles to be found in a large number of periodicals, but they also subject index the pamphlet publications and reports issued by various departments of the Federal and State Governments and by individual organizations.

The Statesman's Year Book, published annually by Macmillan & Company, London, but to be had from any large book store in this country, in addition to giving statistics and information of varied character on all countries and colonies of the world, appends at the end of each section a bibliography of official and non-official books and pamphlets on each country. It is an excellent source for obtaining the names and addresses of official publications of foreign countries.

The Argentine Year Book, the **Japan Year Book**, the year books of all foreign countries, are also sources for pamphlet material, particularly for references to government publications of the respective countries.

Personal Notes and Correspondence

A source of information often neglected by business houses is that within the organization itself, and is to be found especially in its correspondence and reports. A great deal of valuable information is gathered together in field work and in special investigations made by the members of the branches and

departments of an organization, which remains, more or less, in the personal notes of the men making the investigations. Some of these data may be gleaned from their letters and reports, copies of which should be made for the information files, but it is a better plan to have the business organization require these experts to outline briefly for the information files the results of their studies and investigations. By this means a wealth of information will be gathered for the permanent use of the whole organization that otherwise would be lost if these employees left the organization for other positions.

Selection of Material

It is impossible in one or two short articles to list the many sources for information in pamphlet form, or that to be found on specific subjects. With these general sources, as given above, a librarian in a business library begins the organization of data or reference files and from these, new sources of information are constantly being suggested. It is not intended to recommend that all business organizations proposing to organize such files should subscribe for or purchase all of these aids to the accumulation of business facts. Where it is not practical to purchase these helps the business librarian should make it one of his duties to visit regularly the public library in his city and read and check the suggested sources, if available, for the facts

desired, and to anticipate the needs of the business organization and obtain for the files the facts that later will be required.

In selecting material the important requisite, next to knowing sources, is discriminating judgment. The purpose is never to gather a quantity of facts. Space is too valuable in business offices to fill it with printed material that holds no interest for the business house, no matter how valuable it may be to some other house.

In order that the business librarian may be kept in touch with the interests and needs of the business house, the management should cooperate and keep the librarian informed of their needs and new interests as they develop. When the administration of these reference files is in the hands of one person he becomes familiar with the requests and reference questions made to him and learns what to select as of value and what may be discarded. His newspaper and periodical reading will keep him informed as to current events and assist him in choosing live subjects, and day by day as new pamphlets and clippings are added to the file, old ones that are superseded by later information may be discarded. It is a wise plan, however, to take stock once a year and clear the files of out-of-date material and prevent them from becoming historical instead of full of live and current material.

ELECTRIC IRRIGATION IN THE INTER-MOUNTAIN DISTRICT



Typical installation at Centerville, Utah



Typical farm being irrigated electrically

That the many advantages of electric irrigation are steadily making themselves better recognized by the irrigator, is indicated by the fact that prospective new users of electric irrigation service for the coming season in the territory served by the Utah Power & Light Company are fast getting their plants installed and in shape for operation. The installations going in give a striking illustration of the extreme flexibility

of the electric power irrigation plant. The plants include those designed for pumping from sloughs, canals, rivers, dug and drilled wells, and embrace horizontal and vertical centrifugal as well as plunger pumps. Neither are the installations restricted as to size. Those already contracted for this year range from 1000 hp. to 5 hp.



Electrically operated pumping installation on a Utah ranch.



Installation drawing 600 gallons per minute from well 42 ft. deep



DIARY OF AN OLD-FASHIONED FARMER'S WIFE

1:50 p.m. All hands turn in and manage to shear 52 sheep by dinner time.

MORE ELECTRICITY NEEDED ON THE FARM

SPARKS—Current Facts, Figures and Fancy

(The cost of being in the dark, the progress of the electrical idea in India and the piloting of vessels by radio are among the subjects treated on this page. The wealth of Sacramento, the traffic cop's farewell and the latest dream of Colorado Springs are also discussed in brief.—The Editor.)

The West need not fear a cider shortage since Washington produces 20 per cent of the country's apples. The Wenatchee and Yakima valleys are known to ship more than 16,000 cars of apples in a year.

* * *

The electrical idea is creeping into the minds of India's higher caste, according to a recent report that the only living Buddha has ordered two Delco farm lighting sets in order that the royal palace may be all lit up.

* * *

Considering her size, Sacramento is the richest city in the United States in that she leads in bank deposits. With a population of 66,000, the deposits in the several banks amount to \$66,000,000, which exceed that in the treasury of many cities twice her size.

* * *

Poor illumination is surprisingly expensive, according to the figures of an insurance expert, who states that \$300,000,000 is the annual loss in the country due to poor lighting. And further, this amount exceeds the total annual cost of illumination at this time.

* * *

To treble one's size is no easy matter, but the electrical industry must do as much if the nation's available water power is to be developed. Government figures infer that it will cost between \$6,000,000,000 and \$10,000,000,000 to develop the potential water supply of the United States, and this means a trebling of the industry's capitalization.

* * *

The West needs engineers more than any other section of the country and so the West is producing them. The University of California students stood first in a psychological test given 10,000 engineering freshmen in fifty American colleges and universities. The examinations given included a test on general intelligence and five tests on high school subjects, including physics, chemistry, mathematics and manual training.

* * *

Fogs will no longer be a factor in the delay of ships, according to a report which comes from Fort Lafayette, where a vessel was piloted into port by means of a magnetized pilot cable. With the windows of the pilot-house covered by heavy canvas, the commander picked up the cable and guided the ship by "listening in" and steering to port or starboard as the volume of sound indicated his position. The cost of equipping a vessel with receiving apparatus

for this purpose is estimated at \$1,200, while delay because of fog may cost an ocean liner as much as \$500 an hour.

* * *

Speaking of Thanksgiving, we might even be thankful for the automobile tire, even if it does go flat once in a while. In Germany the price of rubber tires still puts them beyond the means of most local motorists, so the iron rim still is very much in vogue. Some of the more prosperous citizens use a thin coating of rubber about the rims of their machines, but few even indulge in this luxury.

* * *

Speaking of Western dreams, Colorado Springs announces a big one which will put her among the most electrical of electrical cities. It is estimated that by an additional expenditure of approximately \$650,000 the city of Colorado Springs can, by use of its present water supply reinforced by diversion from a certain creek through existing and new power houses, generate 15,115,400 kw-hr. per year. And then, in case this will not meet the demands, it is estimated that by an additional expenditure of \$1,125,000 an additional 8,095,400 kw-hr. annually can be obtained.

* * *

We've said farewell to the "steno," the horse and even to the cow, but now Los Angeles is saying farewell to our old friend, "the traffic cop." Electrically controlled semaphores, operated from a central station, are being used to cope with the traffic situation on Broadway. To switch the traffic from north and south to east and west the signals first emit a warning ring, the red light goes out and the green light shows, and semaphore arms bearing the word "Stop" fold away to give place to arms that say "Go." The signals work independently of each other, or work from a central control, according to the convenience of the police.

* * *

Centralized regulation of the production and distribution of electric power and light is the aim of the free city of Danzig, in fostering a project which provides for the creation of a board of electricity whose duties would cover all questions connected with the city's supply of electric current. The project further provides for an advisory council to be composed of seven representatives of the city of Danzig, one representative of each of the remaining municipal and rural districts, one representative of large industry, one of agriculture, and one of small industrial consumers, and two members of the Danzig magistracy.

PERSONALS



Arthur H. Markwart will fill the position of director of engineering which has recently been created as a part of the organization of the Pacific Gas & Electric Company. Mr. Markwart up to this time has been well known as a member of the firm of Galloway & Markwart, Civil Engineers, San Francisco. He was prominent from 1912-1915 as Chief of Construction with the Engineering Department of the Panama-Pacific International Exposition. Mr. Markwart is a graduate of the University of California with the class of 1903. Soon after his graduation

he was an engineer with the California Gas & Electric Corporation, now Pacific Gas & Electric Company, at which time he was appointed assistant civil engineer for the corporation. Later he was chief engineer and manager of the Syndicate Water Company of Oakland and vice-president and manager of the Richmond Water Company. In 1907 he became a member of the firm of Galloway & Markwart which has been especially active in making investigations and reports on hydroelectric plants and irrigation systems, and has designed and constructed bridges and buildings involving many millions of dollars.

Herbert C. Hoover, president of the American Institute of Mining Engineers, is a recent San Francisco visitor.

H. J. Bennett has been made purchasing agent for the Western States Gas & Electric Company, Stockton, California.

J. O. Presbrey, Western representative of the Ivanhoe Regent Works, Cleveland, Ohio, has transferred his office from St. Louis to San Francisco.

J. R. Wilson has succeeded Ed. Peterson as district manager of the Washington-Idaho Water, Light & Power Company at Castle Rock, Washington.

H. C. Parmelee, editor of Chemical & Metallurgical Engineering, has been elected as a member of the executive committee of the National Conference of Business Paper Editors.

H. P. Davis, vice-president of the Westinghouse Electric and Manufacturing Company, and W. K. Dunlap, acting vice-president of the same company, have been recent visitors on the Pacific Coast.

James H. McGraw, president McGraw-Hill Company, Inc., was elected vice-president of the Associated Business Papers, Inc., at its fifteenth annual convention held recently in New York.

R. E. Collom, federal deputy oil and gas supervisor, with headquarters at the San Francisco office of the U. S. Bureau of Mines, attended the convention of the Independent Oil Men's Association, held at Denver, September 28 to 30.

M. J. Gavin, refinery engineer of the Salt Lake City station, U. S. Bureau of Mines, who is in charge of the Bureau's oil shale development work, spent several weeks at the San Francisco office of the Bureau during October.

G. W. Muench, formerly master electrician of the Triangle Electric Company, Inc., 909 East Pike Street, Seattle, was recently appointed manager of that company. Prior to his connection with the Triangle Company Mr. Muench was for some years associated with the Seattle Engineering School as instructor in gas engine electrical appliances. He

has been identified with automotive electrical work for the past fourteen years.

W. H. McGrath, vice-president of the Puget Sound Power & Light Company, with H. J. Gille, district sales manager, G. E. Quinan, chief electrical engineer, L. R. Grant, manager appliance department, and R. W. Lindley, assistant sales manager, Bellingham division, all executive officials of this company, have returned from Boston where they were called early in October to attend a Sales Managers' Conference held by the Stone & Webster interests.

Robert Sibley, editor of the Journal of Electricity, has left for a business trip to the East. He will attend the first meeting of the American Engineering Council which is to be held in Washington, D. C., November 18-20, and will then go to New York where he will attend the national meeting of the A. S. M. E., December 7-10, and will visit the central office of the McGraw-Hill Company, Inc. Mr. Sibley is planning to return to San Francisco on December 15.

E. O. Shreve, San Francisco manager of the General Electric Company, has returned from a trip to the East where he visited the main offices of the company at Schenectady, New York. He attended a conference of the International General Electric Companies at Brier Cliff and among other visits reports one to the New York offices of the McGraw-Hill Company, Inc. Mr. Shreve says that the general feeling in the East is that there will be a general period of recession but that conditions will soon be back to normal and that a period of great prosperity can be looked to.

Frank F. Fowle and James R. Cravath have formed a consulting engineering partnership under the firm name of Fowle & Cravath, with offices at 1201 Monadnock Block, Chicago. Frank F. Fowle, who until recently served as one of the receivers of the Central Union Telephone Company, was formerly a consulting engineer. James R. Cravath is a well-known consulting electrical and illuminating engineer of Chicago. The services of the firm will be devoted to investigations, research, design, supervision, management, appraisals and rate cases in the several fields with which the partners have heretofore been identified.

L. M. Klauber has recently been promoted to be general superintendent of the San Diego Consolidated Gas & Electric

Company, of which he was previously assistant general superintendent. He graduated from Stanford University in the department of electrical engineering in 1908. From 1908 to 1910 he spent in the Westinghouse Electric and Manufacturing Company's graduate apprentice school at East Pittsburgh, Pa. His first position with the San Diego company was that of new-business solicitor, after which he served as engineer in

charge of record department, superintendent of electric department and assistant general superintendent. He is vice-chairman of the overhead systems committee of the N. E. L. A., a member of the electrical apparatus committee and chairman of the Pacific Coast engineering committee.



DIARY OF AN OLD-FASHIONED FARMER'S WIFE

6:45 p.m. Crush five barrels of apples in hand press. Set aside for several weeks.

MORE ELECTRICITY NEEDED ON THE FARM

Dr. Joseph F. Merrill, chairman of the Utah Section of the American Institute of Electrical Engineers, is dean of the engineering college, University of Utah. Dr. Merrill received his Bachelor of Science degree from the University of Michigan in 1893, and continued his studies at the Johns Hopkins University, receiving his Ph.D. from that institution in 1899. His first teaching experience was as assistant professor of chemistry at the University of Utah in 1897. He became di-



rector of the Utah state school of mines and engineering at the University of Utah in 1898, and professor of physics and electrical engineering at that institution in 1899. Dr. Merrill has contributed largely to the electrical engineering profession through extensive research work. Some of his more important theses are as follows: Effect of dielectric on electrical resistance; effect of temperature and pressure of electrolysis of silver nitrate; reliability and durability of commercial integrating meters. He has been one of the most active members of the Utah section of the American Institute of Electrical Engineers since its organization about four years ago. The Utah section will act as host to the national society at the annual convention at Salt Lake City next June.

E. B. Criddle, general agent of the Southern Sierras Power Company, is among recent San Francisco visitors.

B. H. Hurd, of the California-Oregon Power Company, has returned to San Francisco after a tour of the company's system.

W. F. Rawdon has been made Thor Washing Machine specialist in the Seattle office of the Pacific States Gas & Electric Company.

H. L. Jackson, manager of the Western States Gas & Electric Company, Eureka, California, spent a few days in San Francisco recently.

H. S. Warren, public relations engineer for the American Bell Telephone Company, with headquarters in New York, is a recent San Francisco visitor.

R. W. Davenport, a hydraulic engineer on the staff of the United States Geological Survey, has been transferred temporarily to the staff of the Federal Power Commission.

K. G. Dunn, having sold his interest in Hunt Mirk & Co., consulting engineers at San Francisco, has retired from the firm and is devoting his attention to his private interests.

James Allan, who has been assisting in the advertising department of the Pacific States Electric Company, San Francisco, has been transferred to the industrial department for central California, with offices in San Francisco.

C. P. Bowie, petroleum engineer of the U. S. Bureau of Mines, has returned to the San Francisco office after an absence of nearly two and a half months spent at Washington, D. C., and in inspection work at various Eastern and Mid-Continent fields.

L. E. Voyer, illumination engineer with the General Electric Company, San Francisco, has returned from an extended trip throughout the East. He visited various factories of the company and attended the convention of Illuminating Engineers which was held in Cleveland, Ohio.

D. J. Wheat, who has been superintendent of the Alameda County Gas Company District of the Pacific Gas & Electric Company, has resigned that post to become general manager of the Wheat Electric Company, electrical contractors and dealers, at Santa Maria, California.

W. J. Canada, electrical engineer with the National Electric Light Association, formerly with the U. S. Bureau

of Standards and now devoting his time to the study of inductive interference, is recent Pacific Coast visitor and has spent some time in San Francisco and Los Angeles.

A. B. Thompson, railway specialist in the San Francisco office of the General Electric Company, has returned from the East where he attended the American Electric Railway convention at Atlantic City. Mr. Thompson visited the factories of the company and returned via the Chicago, Milwaukee & St. Paul Railway.

Josiah C. Moore, engineer for the Aero Alarm Company, Seattle, has been granted a leave of absence by the company, to go to St. Louis, Mo., for the purpose of designing a large power plant and general equipment engineering work for the James Black Masonry & Contracting Company. Mr. Moore will be gone about two months.

Robert W. A. Brewer, who was a San Francisco consulting engineer until the first of this year and who is now consulting engineer with a large automobile manufacturing concern in Cleveland, Ohio, is leaving for a visit in England on November 17. It is reported that while in London Capt. Brewer will read a paper on Vacuum Valves.

George W. Danforth, Lieutenant-Commander, U. S. Navy, has recently retired and taken up a small farm in the Napa valley. Mr. Danforth is well known on the Pacific Coast for the excellent work he has done in mechanical engineering for the Navy and for his work in San Francisco at the time of the Panama-Pacific Exposition in 1915.

A. L. Kempster, general manager of the New Orleans Railway & Light Company, who has been visiting and closing up business affairs in Seattle, recently left that city for New Orleans. He was manager of the Seattle division of the Puget Sound Traction, Light & Power Company until the traction lines were taken over by the city of Seattle in April, 1919.

C. L. Chamblin, manager of the California Electric Construction Works of San Francisco and president of the California Association of Electrical Contractors and Dealers, is leaving San Francisco November 15 for Los Angeles where he will attend the meeting of the State Advisory Committee of the Association. At this time it is expected that definite plans for the Los Angeles industrial lighting exhibit will be made.

Charles Butters, with the water power and irrigation department of Tasmania, was a recent Utah visitor, looking into the problems of service. Mr. Butters states that Tasmania is entering upon a most comprehensive plan for the utilization of water power and that irrigation is a big question in that country. He also spoke of the international fame which Utah has achieved because of its splendid irrigation systems.

George L. Myers, assistant to the president of the Portland Gas & Coke, Pacific Power & Light, and Walla Walla Valley Railway companies, has been elected vice-president of the Northwest Electric Light and Power Association for the state of Oregon at the recent Spokane convention. For some time Mr. Myers has been especially active in the electrical activities of the Northwest. Previous to his association with the companies mentioned he was with the Oregon-Washington Railroad & Navigation Company. In 1912 he became



treasurer of the Pacific Power and Light Company and private secretary to the president of the three associated companies.

HAPPENINGS IN THE INDUSTRY

REORGANIZATION OF P. G. & E. FORCES

The Pacific Gas & Electric Company of California has reorganized its forces for the purpose of bettering its service and establishing a precise distribution of responsibility.

Committees have been appointed to act in an advisory capacity to executives, and the new positions of director of engineering and executive engineer have been created.

Under the reorganization scheme, Wigginton E. Creed, president of the company, will give special attention to major financing, and with the assistance of an advisory committee will regulate the general policies affecting the operation and regulation of the concern.

John A. Britton, vice-president and general manager, will be in charge of the general operations of the company and will specialize in all matters pertaining to construction, operation and maintenance, contact with the Federal Water Power Commission, competitive conditions and relations with other operating companies. Those who will report to him are the director of engineering, executive engineer, attorney, attorney rate department, manager of the claims department, manager of the property department and the manager of the lands and tax department.

A. F. Hockenbeamer, second vice-president and treasurer, will be in immediate charge of the company's finances, accounting, purchasing and warehousing. The following heads of departments will report to him: secretary, assistant secretaries, assistant treasurers, transfer agent, general auditor, purchasing agent, superintendent of supplies, credit manager and manager of the stock sales.

P. M. Downing, vice-president in charge of electrical construction and operation, will have control of all electrical construction, maintenance and reconstruction, the operation of all hydroelectric and steam-power houses, transmission and distributing lines and substations connected therewith, the street railway system at Sacramento and all water systems of the company.

F. A. Leach, Jr., vice-president in charge of public relations and service, will have control of all commercial activities, public relations, division managers and officers under them, and the gas-manufacturing and distribution departments. Reporting to him will be the gas engineer, manager of the commercial department, manager of the publicity department and division managers.

The new engineering department will be headed by A. H. Markwart. He will have charge of the designing of all company plants and equipment.

The new department of the executive engineer will be headed by W. G. Vincent, Jr. He will have charge of rate schedules and the collection of data on company property, also studying economic factors for the guidance of the various departments.

ELECTRIC MANUFACTURING COMPANY NOTE ISSUE

The recent \$30,000,000 note issue of the Westinghouse Electric and Manufacturing Company was entirely taken up within two hours after it was placed on the market and the notes are now selling at a premium. These were issued as ten and a half-year 7 per cent notes at 94%, to yield approximately 7% per cent. Notes are issued to reduce notes and accounts payable.

The National City Bank of San Francisco is the western house handling these notes.

DECISION ON UTAH "SPECIAL CONTRACT"

Approximately \$1,000,000 will be added annually to the revenue of the Utah Power & Light Company through the recent decision of the public utilities commission of Utah in what is known as the "special contract" cases involving the company's standard power schedules in Utah. By this decision a number of "special" contracts with large power users, which have been in existence for some time, have been declared discriminatory, and these customers are ordered placed on the company's standard schedules.

The contracts involved were entered into before the commission came into existence, and before the power company's present standard schedules were adopted. The commission holds, however, that it has jurisdiction over these contracts, and therefore that it has power to modify the rates mentioned therein.

"The leading thought of the public utilities act," says the decision, "would seem to be that the control of service corporations is taken over by the state; and that power and authority is vested in the commission to supervise and regulate any and all things which are necessary in carrying out the purposes of the law."

It is pointed out that to be effective such control and regulation must include both rates and contracts. It holds that there is no contention on the part of the state that the special contracts under investigation were not legal when made. The contracts, the commission says, contained rates that would persist and

"continue legal unless and until the state steps in and assumes jurisdiction as to said rates."

"The exercise of this right by the state is in the interest of the public generally; primarily to make certain that all sections of the public are being fairly treated as to cost of service. The interest of the public is paramount, and individual and private contracts, if found to be discriminatory or preferential, must give way to furtherance of the principle of justice."

The decision means that approximately one million dollars annually will be added to the revenue of the power company.

Applications for rehearings have been filed by the following:

C. R. Hollingsworth of Ogden, representing the two Ogden cement companies; the Associated Canal companies; Van Cott, Riter & Farnsworth filed applications for the Salt Lake & Utah, the Denver & Rio Grande, the Salt Lake City Union Depot and Railroad Company, the Salt Lake Terminal Company and the Deseret News; Dey, Hoppaugh & Mark filed a petition for the Utah Metal & Tunnel Company; Howat Marshal, MacMillan & Crow for the United States Fuel Company; B. L. Liberman for the Utah Iron & Steel Company and the Utah Steel Corporation; and DeVine, Stine & Gwilliam for the Utah-Idaho Central and the Bamberger Electric Railroads.

NEW RATES FOR PUBLIC SERVICE UTILITIES CONSIDERED BY THE COMMISSION

The Railroad Commission of the state of California is directing an investigation in the matter of rates to be charged for gas and electric energy by the various public service utilities of this state.

These utilities are now operating under war emergency rates, which were granted by the Commission from time to time during the last three years. The advances which have been granted approximate 20 per cent over the pre-war rates and were granted only as a temporary relief to the utilities.



DIARY OF AN OLD-FASHIONED FARMER'S WIFE

7:15 p.m. Feed stock by lantern light.
Drop lantern. Set fire to barn.

MORE ELECTRICITY NEEDED ON THE FARM

The entire question of rate structure for electric companies will be considered at the various hearings which have been planned in all parts of the state.

It is expected that the whole question of rate base will be determined anew at this time, and the inquiry gives promise of being the most important ever begun by the Commission. Many involved questions of finance and valuation must necessarily be decided upon at this time. It has been contended by power companies' attorneys that electric rates should be based upon the cost of generating power in steam plants operated by oil under increasing oil costs. They say that any other principle of rate fixing will cause bankruptcy to certain companies.

The hearing to determine the rates to be charged by the Great Western Power Company in the various cities served by this utility began Monday, November 8. The Pacific Gas & Electric Company hearing follows on November 15.

SOUTHERN CALIFORNIA EDISON COMPANY
RATE CASE

Hearings in connection with the application to establish regular rates for Southern California Edison Company were resumed before President Edgerton of the Railroad Commission in Los Angeles on October 25, after an adjournment of the first session called September 16.

A novel element has been brought into the case by the Edison Company's argument that the company's ability to carry out its building program should have a place in establishing a rate base alongside the customary historical value of past investments. They submit that the completion of the Big Creek program on schedule time and to the best economic advantage demands a steady flow of new money into the enterprise and that this flow must not be interrupted by frequent rate changes which ordinarily would arise from emergency conditions such as the water shortage of 1920.

For the purpose of avoiding such possible rate adjustments they propose a new item in their financial statement to be called an "equalizing reserve" which will be established in the first instance by the voluntary contribution from earnings. Once established, the fund will be increased in years of favorable operating conditions and will be drawn upon when the circumstances are reversed. It is pointed out that the plan does not contemplate adjustments to meet general fluctuations in commodity prices but merely to meet unusual and unforeseen conditions such as "dry" years, labor costs, and serious accidents to plant.

WATER-POWER APPLICATIONS FILED WITH CALIFORNIA STATE WATER COMMISSION
IN AUGUST AND SEPTEMBER

APPLICANT	Applic. Number	Diversion c.f.s.	Storage ac.-ft. an.	STREAM	Estimated Power t.h.p.	Estimated Cost	Concrete Dam	Tunnel or Pipe
J. G. Van Zandt, San Bernardino.....	1962	210	260,836	Santa Ana River	3000	.....	30x235x178	8 miles
C. L. Flack, Los Angeles.....	1968	40	.....	White Water River	1800	\$100,000	12x600x600	10.5 miles
F. M. Hess, Bishop.....	1970	.....	500	Twin Lakes	.....	1,500	.....	.....
San Diego Consolidated Gas & Elec. Co., San Diego	1980	10	.....	Pauma Creek	560	225,000	125x900x25	2.5 miles
G. W. Peer, Los Angeles.....	1984	40	.....	Gold Lake	4500	.....	.....	.....
So. Sierras Power Co., Riverside.....	1997	4.5 12.5 2.0 6.0	.....	Alder Creek, Falls Creek, Lost Creek, Vivian, Willow, and High Creeks — total	5793	500,000	4x10x10	5 miles
San Diego Consolidated Gas & Elec. Co., San Diego	1998	10	12,000	Pauma Creek	680	.....	6x50x10	2 miles
San Diego Consolidated Gas & Elec. Co., San Diego	1999	15	12,000	West Fork San Louis Rey R.	775	235,000	100x200x30	3.5 miles
J. H. Pierce, San Francisco.....	2005	5	100	First Lake	425	.....	.....	.....
.....	2006	5	200	Second Lake	142	.....	.....	.....
.....	2007	5	300	Third Lake	170	.....	.....	.....
Ed. Fletcher, San Diego.....	2013	50	.....	Boulder Creek	.....	.....	40x55x200	4.5 miles
C. F. Wildasim, Bishop.....	2017	1	.....	Mammoth Mining Tunnel	74	8,275	.....	.....
San Joaquin Light & Power Corp., Fresno	2022	200	40,000	North Fork Kings River	.....	.....	.....	.....
.....	2023	80	14,500	Burnt Corral	.....	.....	.....	.....
.....	2024	175	41,000	Helms Creek	.....	.....	.....	.....
.....	2025	140	13,000	Bench Valley Creek	.....	.....	.....	.....

In addition to the equalizing reserve it is proposed to establish a "Reward for Efficiency" account which will be in the nature of employes' participation in earnings. It is expected that the fund will be readily maintained without cost and with profit to the consumer as it will be a direct appeal to employes and will result in a degree of personal efficiency heretofore unknown in the public utility field.

Following the hearing in Los Angeles, adjournment was taken to Visalia at some later date for the benefit of the San Joaquin Valley consumers of the Edison company.

SEATTLE ESTABLISHES ELECTRICAL CODE

An electrical safety code has been established by the city of Seattle. Section 1 of the ordinance reads as follows: "The following provisions shall constitute the electrical code which shall apply to all the electrical equipment hereafter installed in the City of Seattle, but shall not be construed to require that electrical equipment heretofore installed be re-installed until the same shall be found unsafe."

Under this code it is required that a Superintendent of Buildings inspect all work done and shall be given power to suspend any installation which he considers unsafe. A permit passed upon by the Superintendent of Buildings is required for all installations.

Wiring rules for general work are given in detail. Rules for meter location, conduit construction, armored cables, use of metal molding, grounding, knob and tube wiring, and the installation of service fixtures and cutouts are all given in detail as well as rules for the installation of cabinets and cutout boxes, fixtures, sockets, flexible cords, generators and motors, switchboards, cranes, heaters and ranges, electric signs, transformers, elevators, and all theatrical equipment.

SELLING ILLUMINATION

The man of industry appreciates what good lighting will do, but he seldom appreciates what good lighting really is. For this reason, the Industrial Lighting Exhibit Committee of the California Electrical Cooperative Campaign has planned a permanent industrial lighting exhibit for the city of San Francisco. The exhibit is practically finished and will be open soon after November 15. Illumination engineers who have been visiting lighting exhibits throughout the nation state that this one is by far the most permanent and complete in the United States. All wiring is iron conduit and done just as it should be for permanent use. The reflectors are all raised and lowered by pulleys, and the main switchboard

which has been made to order is permanently installed, being a safety panel. Reflectors will be installed for the benefit of the store man. Probably fixtures of various types will be used.

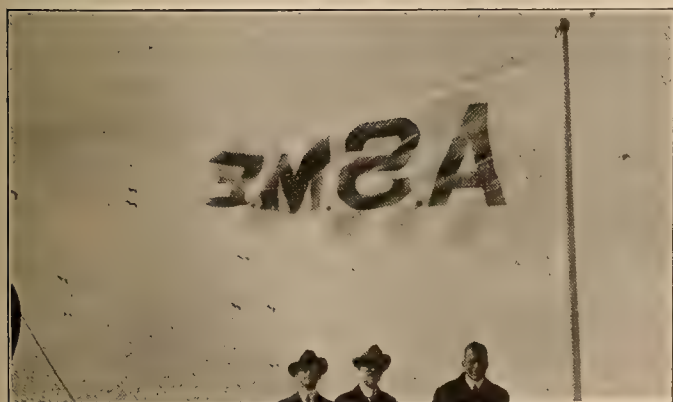
U. S. S. CALIFORNIA VISITED BY A. S. M. E.

The San Francisco Section of the American Society of Mechanical Engineers celebrated the fortieth anniversary of the society, November 4, by visiting the U. S. S. California now being constructed at the Mare Island Navy Yard. Special invitations featuring the progress made in the construction of naval vessels on the Pacific Coast were issued to the members of the local sections of the American Society of Mechanical Engineers, the American Institute of Electrical Engineers, the American Society of Civil Engineers, the American Chemical Society, the Institute of Radio Engineers, as well as personal invitations to some of the members of the Illuminating Engineering Society. Anticipating a possible attendance of 75 or 100, the list of acceptances reached nearly 300.

After arriving at the navy yard the first visit was to the cafeteria where an address of welcome was made by Captain Beach, commandant of the Mare Island Navy Yard, followed by luncheon during which several musical numbers were rendered by the employes' band and quartet. After luncheon there followed an address by Commander B. Bruce, U. S. N., Machinery Division, Navy Yard, Mare Island, on the Electric Propulsion as applied to the U. S. S. California. This was followed by an address by Lieutenant C. W. Colby (CC), U. S. N., Hull Division, on Structural Features, U. S. S. California.

The visitors were divided into twelve groups and were taken, each group by a guide over the points of interest, including the guns of the "California," the New Structural Group, Dry Docks, Machine Shop Nos. 1 and 2, the Destroyers, the U. S. S. California which is to be the electrically propelled sister ship of the New Mexico and the U. S. S. Montana which is just being started.

The California will be the flagship of Admiral Rodman, Commander-in-Chief, Pacific Fleet, and, in addition to the 15 officers on his staff, will carry 57 commissioned officers, and 1400 men including 75 marines.



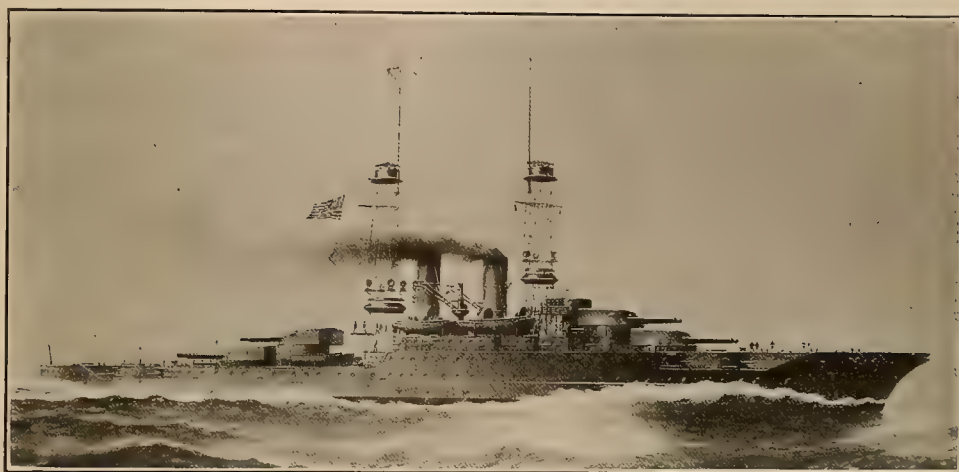
From left to right: W. W. Hanscom, chairman A. S. M. E., W. F. Durand, and Robert Sibley, editor Journal of Electricity, rallying 'round the flag.

Men of the electrical industry were pleased to learn that electricity will be used for the following purposes in addition to propelling the ship: Lighting, ventilation, steering, hoisting anchors, handling boats, and the operation of laundry machinery, dish-washing, meat-chopping, ice cream freezing, potato peeling, etc.

The armament consists of twelve 14 in., 50 cal. rifles; fourteen 5 in. rapid-fire guns; four saluting 6 pounders; four 9 in., anti-aircraft guns; one 3 in. landing gun; two 1 pounder boat guns and four 21 in. submerged torpedo tubes.

SECURITIES AMOUNTING TO OVER 45 MILLIONS AUTHORIZED IN CALIFORNIA THE PAST YEAR

The report of the Railroad Commission for the fiscal year ending June 30, 1920, shows that over 45 million of the \$59,413,772.56 authorized for additions and betterments to



The "California," sister ship of the "New Mexico," is nearing completion. It is 624 ft. long and 97 ft., 5 1/2 in. wide. It is electrically driven, each shaft carrying its independent electric motor which takes current from either one of two independent, turbine driven generators. There are four shafts and each shaft horsepower is 26,800. They make 175 revolutions per minute.

the state's utilities during the year was granted to power companies.

This sum, according to the orders of the Commission, is to be spent as follows:

Great Western Power Company of California—7% preferred stock to continue the construction of a new hydroelectric plant on the north fork of the Feather River.....	\$1,500,000.00
Los Angeles Gas and Electric Company—Bonds to finance general construction expenses	\$1,626,000.00
Pacific Gas & Electric Company—Convertible gold notes to finance construction of hydroelectric plants on the Pit River and its tributaries	\$10,000,000.00
San Joaquin Light and Power Corporation—\$4,498,800 bonds and \$3,500,000 preferred stock to complete 45,000-hp. Kerckhoff hydroelectric power plant and install a 17,500-hp. unit in its steam plant at Bakersfield; total.....	\$7,998,800.00
San Diego Gas and Electric Company—Stock to finance new construction	\$555,800.00
Southern California Edison Company—\$12,500,000 bonds and \$7,700,000 common stock to carry forward the construction of its hydroelectric power plant on the Kern River (Kern River No. 3), enlarge one of its Big Creek power plants, and other improvements; total.....	\$20,200,000.00
Southern Sierras Power Company—Bonds to pay for new properties and indebtedness incurred because of the acquisition and construction of new properties.....	\$1,095,538.20
Snow Mountain Water and Power Company—Preferred stock to pay the cost of constructing Gravelly Valley dam and other improvements	\$1,500,000.00
Western States Gas and Electric Company—Preferred stock to finance new construction.....	\$603,000.00



DIARY OF AN OLD-FASHIONED FARMER'S WIFE

8:00 p.m. Go to bed in dark. Tired out.

MORE ELECTRICITY NEEDED ON THE FARM

Meeting Notices for Electrical Men

(Unusually important meetings of the contractors and dealers in the Northwest and in California are reported in the following pages. The story of the recent Del Monte Jobbers' convention is told and a condensed account of the recent meeting of the Engineering Committee of the Pacific Coast N. E. L. A. is given.—The Editor.)

Combination Safety Code Discussed at Contractor-Dealer Executive Committee Meeting

The time and expense of attending meetings, the problem of bidding for government construction work, the Combination Safety Code, and the attractiveness of the electrical retail business were the outstanding subjects of discussion of the October meeting of the Executive Committee of the California State Association of Electrical Contractors and Dealers, held on the 29th and 30th at the Glenwood Inn, Riverside.

At this time the following were made members of the Association:

Goodell & Halverson, Pomona;
Granger Electric Company, Santa Ana;
W. J. Rainville, Willows;
Glenn County Electric Works, Willows;
Coalinga Electric Shop, Coalinga;
Stewart Kinder Electric Co., Lodi;
S. P. Good, Clovis; Townsend Electric Shop, Selma.

Extensive consideration was given in an effort to reduce the time and expense necessary for members attending the numerous association meetings which are now on the regular schedule. To this end a plan of reorganization of state work was presented and considered. This is to be reported upon in detail to the entire association at the quarterly meeting which is to be held immediately after the holidays in the vicinity of San Francisco.

A letter to the General Contractors of America has been received from L. L. Calvert, Lieut.-Colonel, Quartermaster Corps, Construction Division of the U. S. Army, asking why contractors are no longer bidding on government work. The letter states that during June bids were requested for 17 large projects, all over \$100,000 and totaling \$8,000,000, and only 62 proposals were received. According to the discussion of the Executive Committee, the Government does not pay enough to make this type of work worth while. Often the contractor's bid is used only as a basis for government men to figure on the project and do the work within the Construction Division without any outside help. A reply to this effect is to be sent Lieut.-Colonel Calvert.

R. L. Eltringham spoke on the proposed Combination Code and on the Licensing Law.

Development of Arizona Urged at Meeting of Citizens

At a recent meeting of the citizens of Clifton, Arizona, Senator Cameron's program for the development of the state through federal aid was received with great enthusiasm. He said:

"With electrical power developed from the Colorado River project the mines can be operated at almost one-half of present overhead expenses. The same power will also bring down into southern Arizona a sufficient current to make practical the operations of pumping plants to reclaim more than 3,000,000 acres of desert land."

McMeen Addresses Los Angeles Section

"Big Things from Little Ones" was the subject of an address by Samuel McMeen, expert on public utility management from Columbus, Ohio, before the Los Angeles A. I. E. E.

Taking his theme from the centennial of the fundamental discoveries of Ampere, Arago and Davy in 1820, Mr. McMeen commented on the relative unimportance of these and similar accomplishments at the time and then their immense bearing on modern conditions. As a telephone expert, Mr. McMeen sketched the romantic history of telephony and predicted that the next few years will see startling events in this field. He was followed by J. H. Lighthipe, chief electrical engineer for the Edison

Company, who entertained the gathering informally with some personal reminiscences of Thomas A. Edison.

The Los Angeles Section plans to devote future programs to the consideration of California's power program with reference to the work of the Southern California Edison Company in the Big Creek project.

Electric Railway Talk at the Seattle A. I. E. E. Meeting

The October meeting of the Seattle Chapter of the A. I. E. E. was presided over by Dr. C. E. Magnusson, of the University of Washington, in the absence of G. E. Quinan, chairman, who at the time was attending a Sales Manager's Conference held by the Stone & Webster interests in Boston.

C. Anderson, an engineer with the Westinghouse Electric & Manufacturing Company, was the speaker of the evening, giving an illustrated lecture on the "Power

Indicating and Limiting System in Use on the Western Division of the Chicago, Milwaukee & St. Paul Railway." Mr. Anderson gave a clear and minute description of the system, showing by means of lantern slides the electrical circuits used, and the motors which regulate and indicate the amount of power used by the company's system. A discussion followed the delivery of this paper.

BUILDERS OF THE WEST — LXXXIX



ELWOOD MEAD

Nowhere else in the world have water-right institutions been more helpfully evolved for the uses of mankind, or rural institutions been more highly developed for the advance of the people generally than west of the Rocky Mountains. To Elwood Mead, professor of Rural Institutions at the University of California, this issue of the Journal of Electricity is affectionately dedicated for his monumental work in behalf of the West, as instanced in the development of the water-right laws of Wyoming, the establishment of a successful farm settlement system in California, and the introduction of a progressive irrigation policy in far off Australia.

COMING CONVENTIONS

ELECTRICAL SUPPLY JOBBERS' ASSOCIATION

Semi-Annual Meeting—Cleveland, Ohio
November 17, 18, 19, 1920

AMERICAN ENGINEERING COUNCIL OF THE FEDERATED AMERICAN ENGINEERING SOCIETIES

Washington, D. C.—Nov. 18-19, 1920

PACIFIC COAST RADIO CONVENTION

The First Pacific Coast—San Francisco, Cal.
November 25, 26, 27, 1920

A. S. M. E. ANNUAL MEETING

New York City—Dec. 7-10, 1920

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS

Annual Convention—Salt Lake City, Utah
June 20-26, 1921

Northwest Service League Endorsed at Convention of Oregon Contractor-Dealers

The all-absorbing topic and the one receiving the greatest amount of attention at the ninth annual convention of the Oregon Association of Electrical Contractors and Dealers, held in Portland October 15 and 16, was the Northwest Electrical Service League which came into being at the September convention of the Northwest Electric Light and Power Association. The Northwest Electrical Service League is the result of the work of the Northwest Electric Light and Power Association, which committee was composed of contractor-dealers, supply jobbers, electrical manufacturers and central station men, and is modeled closely after the California Electrical Cooperative Campaign and has similar objects and purposes. The League was unanimously endorsed by the Association and both moral and financial aid pledged.

Mr. John R. Tomlinson of Pierce-Tomlinson Electric Company, Portland, was re-elected to act as one of the Association's representatives on the advisory committee of the League, and Mr. S. G. Jaggar of the Morrison Electric Company, Portland, was elected to replace Mr. R. C. Kenney who found it impossible to continue to serve.

Mr. O. B. Coldwell of the Portland Railway, Light & Power Company addressed the convention on "Mutual Interests," during which he stated that central stations generally had gone out of the wiring business, had quit merchandising at a loss and recognized the fact that the contractor-dealer was a very necessary part of the electrical industry. After outlining the work done by the Advisory Committee of the Northwest Electric Light and Power Association culminating in the adoption of their report at the Spokane convention, Mr. Coldwell stated that the Executive Committee of the Northwest Association had the day before taken the preliminary steps toward raising the central stations' share of the fund for the first year's work of the League.

The Oregon Association very much appreciated the attendance of Mr. J. W. Redpath, secretary of the California Association, whose address on the subject of cooperation in California left no doubt in the minds of his hearers as to the practical value of cooperation to the contractor-dealer as well as the other branches of the industry. Some of the tangible results of cooperation mentioned by Mr. Redpath were: a 100 per cent increase in retail business during 1919 over the previous year; the increase in number of convenience outlets; that builders were being convinced that they were not building for the present but for the future and that adequate wiring must be provided to meet future electrical requirements; that as a practical demonstration to central stations that the cooperation of California contractor-dealers is more than sentiment, plans are being worked out by the California association to invest its funds in central station securities.

Fred Todd of the Pacific States Electric Company, with the aid of some specially prepared charts, covered the results of the California Cooperative Campaign, and showed what might be accomplished along similar lines by the Northwest Electrical Service League.

L. B. Smith of Portland delivered an address on "Salesmanship." He emphasized the fact that confidence is the real basis of salesmanship and business, and pointed out that dealers' salesmen should thoroughly know the merchandise they are to sell before being allowed to solicit sales.

At the Executive Committee meeting held on the morning of October 15, it was decided to propose to members outside of the Portland district, the division of the state into seven districts, thus making possible the holding of regular meetings by the members in each district. The chairman for each district automatically becomes a member of the State Executive Committee.

At the business meeting of the Association six firms were admitted to membership. The Association went on record as opposing the proposed amendments to the constitution and by-laws of the National Association which provide for the election of Pacific Coast Executive Board members and state chairmen by ballots sent out by the National Association. The Association also endorsed the plan to retain one-half of the dues paid the National Association from Washington, Oregon and California, to be used in carrying on National Association work in the Pacific Coast section.

Municipal Electricians to Meet in Colorado Springs

The 1921 convention of the International Association of Municipal Electricians will be held in Colorado Springs. It is understood that it will be held some time in October, and approximately 300 electricians from all parts of the United States and Canada will be in attendance. City Electrician Caldwell was elected vice-president of the association at the 1920 convention held in New Orleans the latter part of October.

High Voltage Transmission and Inductive Interference Among Subjects Discussed at Meeting of N. E. L. A. Engineering Committee

Under the direction of L. M. Klauber, chairman of the Engineering Committee of the Pacific Coast Division, National Electric Light Association, a meeting of this committee was held in Los Angeles November 4th, 5th and 6th.

The general purpose of the gathering was to outline the work for the coming year which terminates with the annual convention, to gather data for the various reports to be submitted at that time and to consider the best way for the members to work in the interests of the national committees following the same lines, and to which these committees, for the most part, report. It was explained that the Association is now organized in such a way that the general committees do not work with the convention of the geographical section as a goal, but rather, report to their respective national committees which in turn report to the national convention. At the same time there are other committees which were organized to consider problems peculiar to the section and these will report direct to the section convention. In the latter class are committees in Power Resources, Load Dispatching, 220,000-Volt Transmission, Relays, Licensing Engineers, and Rates Based on Power Factor.

Mr. Klauber stated that the purpose of the organization as now established is to distribute the work in order to obtain a group rather than an individual opinion and also to relieve those willing workers on whom associations of all types depended.

On account of fuel conditions in the West, as well as the insistent demand for power, it is felt that one of the most important duties of this organization lies in the work of its Hydraulic Power Committee. This branch will undertake the study of everything surrounding hydraulic possibilities, such as the relation between snowfall and runoff, the loss of natural energy due to evaporation and the most modern methods of predetermining rainfall. In this work they no doubt will be assisted by the Western sections of the A. I. E. E. which will, during this winter, devote considerable time to the same subject.



DIARY OF AN OLD-FASHIONED FARMER'S WIFE

10:00 p.m. Awakened from sleep by baby. Have to heat water on alcohol stove.

MORE ELECTRICITY NEEDED ON THE FARM

ELECTRICAL SUPPLY JOBBERS HOLD ENTHUSIASTIC MEETING AT DEL MONTE



C. C. Hillis, of the Electric Appliance Company, San Francisco, is the competent chairman of the Pacific Division, Electrical Supply Jobbers' Association.

Pacific States was sounded by John A. Britton. The amount of irrigating still to be done, the growth of industrial work, the growth of the central station industry, the developments projected by the central stations for the next ten years—all these Mr. Britton showed were indicative of the

After the Pacific Division of the Electrical Supply Jobbers' Association had met in its regular fall session at Del Monte, California, on October 21 and 22, the meeting on Saturday morning, October 23, was given over to an open session. That session proved to be of especial interest because of the part that it was shown the jobber would play in the great hydroelectric development planned in the West during the next decade.

A very interesting chart had been prepared by J. M. Morris, sales engineer of the Westinghouse Electric & Manufacturing Company, on which was shown the approximate amount of materials which would be purchased for every kilowatt of hydroelectric energy generated. These estimated costs were taken in steps covering generation, transmission, distribution and utilization, and gave a good idea of the amount of electrical apparatus and material which will be required in the development already planned.

A particularly optimistic view of the electrical industry at the present time and for the future among the

wealth which was bound to come to the Western states in the near future.

In discussing the effect of the electrical industry upon other industries, A. Emory Wishon, assistant general manager of the San Joaquin Light & Power Corporation, brought out the features whereby the electrical industry was the basic industry of virtually all of the other industries, particularly in the West, and one which would be the last to feel any depressions which might come in other industries and even then to a lesser degree.

The financing of all these immense developments was discussed by A. N. Kemp, comptroller of the Southern California Edison Company, who spoke of the creation of public wealth and of the great public wealth which he saw ahead in the West. He brought out the means whereby wealth was attracted into the public utilities, commended the recent attitude of the Railroad Commission in regard to regulatory bodies wherein responsibility goes with authority and predicted a better basis of financing for the utility companies in the future under this policy. The organization of a Speaking Bureau to carry in a voluntary way this message of the electrical industry to all kinds of organizations in the community was presented by Robert Sibley, editor of the *Journal of Electricity*, who mentioned in detail several mat-



Dave Harris, Pacific States Electric Company, photographed with the usual cigar, won the famous Jobbers' Cup in the golf contest.



J. M. Morris, Westinghouse Electric & Manufacturing Company, Los Angeles, at the left, presented the leading paper at the convention, but does not see why that makes him a subject for photographers. K. E. Van Kuran of the same company had charge of the meeting and has been complimented on its success.



At the left C. E. Wiggin of Dunham, Carrigan & Hayden, and F. Beck of the National Carbon Company, were caught before they had quite finished arranging their smiles. At the right is John A. Britton, Pacific Gas & Electric Company, responsible for an inspiring paper forecasting the immense industrial growth of California.

ters which should be given publicity and the mediums through which this could be accomplished. He sounded rather a personal note when he touched upon Western pioneers in the electrical industry, but showed the value of this personal factor in the publicity which should be carried on throughout the state.

To relieve the seriousness of the situation, the convention wound up with a special dinner Saturday evening at which, beside the customary speeches, there was a presentation of the golf cups to the winners of the respective matches held from time to time during the convention. T. E. Bibbins received the Turner trophy, Hal Lauretzen the Deming trophy, D. E. Harris the old copper cup and R. E. Fisher the Central Station cup.

REGISTRATION, JOBBERS' MEETING

Airey, F. J., Pacific States Electric Co.	Los Angeles
Alexander, E. G., Alexander & Lavenson Co.	San Francisco
Alvord, R. M., General Electric Co.	San Francisco
Anderson, S. B., Pacific States Electric Co.	San Francisco
Barbion, H. L., Montana Electric Co.	Butte, Mont.
Beck, F. G., National Carbon Co.	San Francisco
Booth, P. H., Edison Elec. Appliance Co.	Ontario, Cal.
Britton, J. A., Pacific Gas & Electric Co.	San Francisco
Bach, C. R., Manhattan Elec. Supply Co.	San Francisco
Berry, W. S., Western Electric Co.	San Francisco
Bibbins, T. E., Pacific Gas & Electric Co.	San Francisco
Curtiss, G. H., Elec. Ry. Mfg. Supply Co.	San Francisco
Daley, Harry H., Majestic Elec. Development Co.	San Francisco
Davis, L. W., Westinghouse Elec. & Mfg. Co.	Los Angeles
Elliot, A. H., Pacific Coast Sec., E. S. J. A.	San Francisco
Fisher, Earl, Pacific Gas & Electric Co.	San Francisco
Garbutt, H. L., Westinghouse Elec. & Mfg. Co.	San Francisco
Graham, N. W., Graham Reynolds Co.	Los Angeles
Greenfield, W. S., Allied Industries, Inc.	San Francisco
Gregory, S. B., Arrow Elec. Co.	San Francisco
Hall, C. B., Illinois Elec. Co.	Los Angeles
Harper, H. L., Western Electric Co.	Los Angeles
Harris, D. E., Pacific States Electric Co.	San Francisco
Hawley, C. B., Intermountain Electric Co.	Salt Lake City
Holabird, R. D., Holabird Electric Co.	San Francisco
Holterman, R. J., Holabird Electric Co.	San Francisco
Howell, H. D., Westinghouse Lamp Co.	Denver, Colo.
Hillis, C. G., Electric Appliance Co.	San Francisco
Irwin, A. M., Westinghouse Elec. & Mfg. Co.	San Francisco
Kemp, A. N., Southern California Edison Co.	Los Angeles
Lauritzen, Hal, Duplex Lighting Works of G. E.	New York City
Lillard, O. W., Gould Storage Battery	San Francisco
Morris, Jno., Electric Supply & Equipment Co.	Hartford, Conn.
Murphy, R. W., McCandless Miniature Lamp Works.	New York City
Oakes, R. F. and W., National Carbon Co.	San Francisco
Parker, J. H., J. T. Parker & Son.	Parkersburg, W. Va.
Pollard, J. F., Coast Valleys Gas & Electric Co.	Salinas, Cal.
Pomeroy, J. G. (and daughter), Manufacturer's Agent.	Los Angeles
Presbrey, J. O., Ivanhoe Regent Works of G. E.	St. Louis, Mo.
Randall, H. D., General Electric Co.	Salt Lake City
Sanderson, H. E., Bryant Electric Co.	San Francisco
Sawyer, W. B., Jr., U. S. Steel Products Co.	San Francisco
Sibley, Robert, Journal of Electricity	San Francisco
Snell, T. W., Sierra & San Francisco Power Co.	San Francisco
Steel, M. F., Benjamin Elec. Mfg. Co.	San Francisco
Stubbs, O. B., Stubbs Electric Co.	Portland, Ore.
Thompson, C. E., Westinghouse Elec. & Mfg. Co.	San Francisco
Vendegrift, J. A., National Lamp Works of G. E.	Oakland
Van Kuran, K. E., Westinghouse Elec. & Mfg. Co.	Los Angeles
Wagner, B. A., Allied Industries, Inc.	San Francisco
Wiggin, C. E., Dunham, Carrigan & Hayden	San Francisco
Wishon, A. E., San Joaquin Light & Power Corp.	Fresno
Wolfsburg, R., Allied Industries, Inc.	Los Angeles

Contractor-Dealer Association Formed in Tacoma

The electrical contractors and dealers of Tacoma, Washington, have formed an association which is a branch of the National Association of Contractors and Dealers. David T. Dixon is president of the new organization, J. L. Fugate, secretary-treasurer, and R. R. Lang, chairman of the executive committee.

Forwarding California Industries

Two recent San Francisco meetings of the California Industries Association have featured the possibilities of wider markets for California industries. The meeting of October 28 was a joint luncheon with the Foreign Trade Club of San Francisco which was addressed by business men in touch with China and Mexico, who told of the favorable conditions now prevalent in both countries. On November 4 Sidney Levy, of the Levy Company of San Francisco, told of the practical lessons to be learned in the establishing of a manufacturing business in the West. A special program featuring the activities of the American Legion was held on Armistice Day.

Important Resolutions Passed by Pacific Coast N. E. L. A. Advisory Committee

The electrical home was an especially prominent subject of discussion at the recent meeting of the Advisory Committee of the Pacific Coast N. E. L. A. held in San Francisco, October 19 and 20.

A motion was passed requiring that a comprehensive report be made covering the activities of the California Electrical Cooperative Campaign on convenient outlets and electrical homes, this report to be in such form that it can be sent out by the Advisory Committee for the information of subscribers to the Campaign and the electrical industry generally. In order to make the position of the committee clear as to the financial responsibility to be taken for the establishment of electrical homes, the following resolution was passed:

"The Advisory Committee will not undertake to establish an electrical home exhibit in any locality unless the local electrical interests have first provided the necessary money required according to a budget prepared by a local Electrical Home Committee which has been appointed with the approval of the Advisory Committee, and which has prepared the plans and the budget for the electrical home exhibit approximately as outlined in the 'Bulletin on Modern Electrical Homes' of the Cooperative Campaign; and provided further that the local electrical interests through this Electrical Home Committee agree to pay the expenses of the electrical home exhibit as contemplated by the budget, together with any additional expense approved by the Electrical Home Committee and all other proper claims which may arise from the installation and operation of the electrical home. And also it is the sense of the Advisory Committee that it is unnecessary for the electrical industry to assume any part of the cost of advertising done by the subdivider owning the home or any part of the subdivider's expense in preparing or exhibiting the home."

Mr. Arbogast presented a letter from Mr. Spring describing the plan which the Southern California electrical contractors and dealers have evolved for the use of 15,000 of the number two wiring plan. They contemplate mimeographing on the back of these plans a list of their members.

Washington Contractors and Dealers

The annual meeting of the Washington Association of Electrical Contractors and Dealers was held in Seattle, on November 4. At this meeting officers of the association, who will serve during the coming year, were elected. V. S. McKenny of the NePage-McKenny Company, Armour Building, Seattle, is president and Forrest Smith, Boston Block, is secretary.

Public Policy Committee, N. E. L. & P. Association

The members of the Public Policy Committee of the Northwest Electric Light and Power Association for the state of Oregon have been appointed by Geo. L. Meyers, vice-president for that state. They are as follows:

R. M. Boykin, vice-president and general manager North Coast Power Company, Portland; A. B. Bower, manager Condon Electric Company, Condon; C. M. Brewer, vice-president and general manager Mountain States Power Company, Albany; C. J. Edwards, president Coast Power Company, Tillamook; T. H. Foley, vice-president and manager Bend Water, Light & Power Company, Bend; H. V. Gates, president Heppner Light & Water Company, Portland; R. M. Jennings, manager Douglas County Light & Water Company, Roseburg; J. L. Kronenberg, president Bandon Light & Power Company, Bandon; J. P. Lottridge, manager Eastern Oregon Light & Power Company, Baker; L. P. Lumpee, manager Vale Electric Company, Vale; H. F. McCormick, manager St. Helens Light & Power Company, St. Helens; L. T. Merwin, assistant general manager Northwestern Electric Company, Portland; R. J. Moore, president Yamhill Electric Company, Newberg; J. F. Orr, district manager Idaho Power Company, Payette, Idaho; J. W. Ralph, secretary Hermiston Light & Power Company, Hermiston; R. C. Reese, president Prairie Power Company, Prairie City; E. G. Robinson, president Molalla Electric Company, Canby; J. A. Ruble, president and manager Amity Light & Power Company, Amity; C. L. Shattuck, superintendent Deschutes Power Company, Prineville; C. M. Shinn, vice-president and manager Cottage Grove Electric Company, Cottage Grove; J. T. Thompson, manager Sheridan Light & Power Company, Sheridan; E. M. Townsend, Portland Railway, Light & Power Company, Portland; H. L. Walther, division superintendent California-Oregon Power Company, Medford; I. H. Watts, Preston-Shafer Milling Company, Athena.



DIARY OF AN OLD-FASHIONED FARMER'S WIFE

1:00 a.m. Awakened by rain. John falls over rocking chair while hunting for matches. Swears.

MORE ELECTRICITY NEEDED ON THE FARM

LATEST IN EVERYTHING ELECTRICAL

(The farmer or the dealer who sells to the farmer will be interested in the description of a popular farm lighting and power plant which appears here and in the presentation of a new rheostat for charging batteries. An electrically operated advertising sign invented in the West is also described here along with a new transformer, a combination switch and receptacle plant and a new line of insulating varnishes.—The Editor.)

THE WILLYS LIGHT AND POWER PLANT FOR THE FARMER

Since June, 1920, Willys Light electric light and power plants have been ordered from the Toledo factory by the Roberts Manufacturing Company, San Francisco distributors of these plants. This fact shows that even the farmer in remote districts is converted to the electrical farm idea. This type of plant is also serving as a pioneer of the electric idea in countries of the Orient.

The simplicity of the Willys Light is its most distinctive feature. It consists of an engine-generator unit and a storage battery. The engine generator is made up of a Knight sleeve-valve, air-cooled engine, a direct connected Auto-Lite generator and a simplified Auto-Lite control. A two-gallon fuel tank is located in the engine base. The kerosene, gasoline, distillate or alcohol is supplied to the mixing valve by suction.

The generator, directly connected to the engine, has four poles and a simple shunt winding. The armature is slipped on and revolves with the crankshaft.

The battery has a capacity of 225 ampere-hours and can be charged with two gallons of kerosene. One charge will pump one hundred gallons of water every day, wash four tubs of clothes, heat the electric iron, run a vacuum sweeper and churn.

ELECTRICALLY OPERATED ADVERTISING SIGN

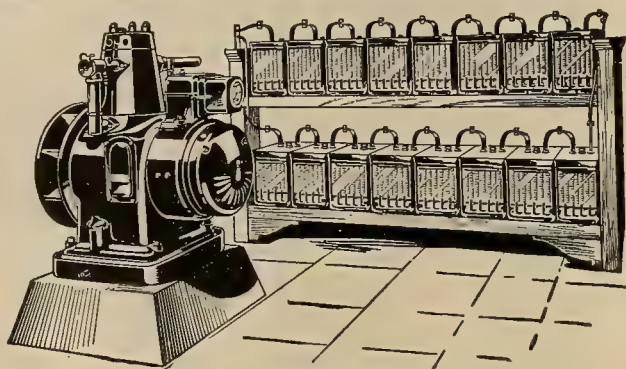
For displaying advertising cards in shop windows, a motor driven card display machine is being manufactured by



The advertising card is changed every minute or so by this new motor-driven card display machine.

the United Advertising and Sales Company of San Francisco, California. By this machine 24 cards of standard street car size are continuously rotating, individual cards sliding into view at definite intervals. Chains at both ends of the machine are driven by a Westinghouse type CA, 1/20-hp., 110-volt, 1750 r.p.m. motor through a horizontal shaft, worm gear and belt.

The machine originally brought out



The Willys Light electric and power plant

was constructed largely of wood but later dies and patterns were made whereby all parts of the machine are now being constructed of metal, making a very substantial machine.

NEW TYPE TRANSFORMER

The Acme Apparatus Company, Cambridge, Massachusetts, has placed on the market a new transformer. This is designed to produce direct current at 375 volts and 550 volts. It is made in 50-watt and 200-watt sizes, for use with rectifying tubes, a small conductor on an Acme 1.5-Henry choke coil. These transformers are also provided with windings for use in heating the filaments of the rectifying tubes and the oscillating tubes which are used in the generation and modulation of the continuous wave current.

HEATER TO ATTACH ON FAUCETS

A device which heats the water as it flows through the faucet has been developed by the National Electric Water Heater Corporation of New York City. This device can either be attached to the faucet directly or by means of a rubber hose, whenever such a feature is desired.

DEVICE FOR TESTING CIRCUITS FOR CONTACTS

An instrument for testing open or short circuits in houses, factories or motor windings has been developed by the Electric Signal Manufacturing Company of Orange, New Jersey. This instrument, which goes under the name of the Emka Buzzer Tester, is in reality a combination of buzzer, telephone connection and battery in one set.

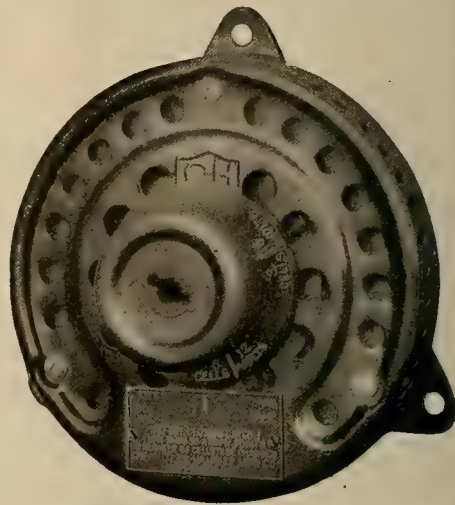
NEW LINE OF INSULATING VARNISHES

Those concerned with the manufacture or maintenance of electrical equipment will be interested in a new and complete line of insulating varnishes and japans, which have been placed on the market by the General Electric Company, Schenectady, New York. Varnishes are divided into two general classes known as black varnishes and yellow, or clear varnishes.

RHEOSTAT FOR CHARGING BATTERIES

The users of farm lighting equipment appreciate the importance of having simple charging rheostats of reliable construction for keeping their automobile batteries in good condition. The new C-H Charging Rheostat, shown in the illustration, is said to stand up exceptionally well, even under severe conditions, and is easily installed and operated.

The rheostat is connected in one of the lines from the 32-volt generating set and in series with the battery to be charged. A dial plate underneath the operating handle is marked to indicate the proper setting for charging certain numbers of cells. The handle is moved



To charge small batteries with this rheostat, set the dial to correspond to the number of cells to be charged, and throw a switch. Used with the farm lighting plants.

until the arrow is at the proper point on the dial plate, after which the battery circuit is closed, and the charge begins.

COMBINATION SWITCH AND RECEPTACLE PLATE

The Peerless Light Company, Chicago, is offering a new type of combination switch and receptacle plate with removable doors. This plate is suitable for either the old type No. 1908 receptacle or the new type standard flush receptacle.

TRADE NOTES

Opportunities in South America —

The manufacturer of electrical goods is looking to South America as a fresh market for his wares. In all parts of the continent plans are being made to develop and use the potential hydroelectric power which is practically unlimited. The following tabulation of the projects which are being planned in the various countries gives some conception of the vast development which is taking place.

HYDROELECTRIC PROJECTS OF SOUTH AMERICA

Project	Location	Constructors
*ARGENTINA:		
150,000 hp. hydroelectric plant.	Falls of the Iguazu (one of the world's best single resources).	Gov. of Argentina Uruguay & Brazil.
†Power plant	Mendoza	La Empresa de Luz y Fuerza (German Co.).
Power station, extension tunnel & aqueduct system costing \$5,600,000.	Falls of Rio Blanco	Municipality of Mendoza
BRAZIL:		
Power plants for and elect. of RR.	Brazil	Gov. of Brazil
30,000 hp. power plant	River Jacuhy	Bids asked for construction by Dept. Porto Alegre
Contracts for furnishing 8,400,000 kw-hr. which is being electrified		La Empresa Electra de Jandiah and the Sao Paulo Elec. Co.
270,000 hp. power plant	Rio de Janeiro	Internationally organized company having American interests
Electrification of central Brazil RR.	From Barra to Pirahy	Gov. of Brazil
Two hydroelectric plants and inst. of street car service.	Vac. of Rio Janeiro	
Power plant and electrification of Victoria-Minas RR.	West Central Brazil	Itabira Iron Ore Co.
Construction and exploitation of high temperature furnaces, a steel factory and reducing apparatus	West Central Brazil	Itabira Iron Ore Co.
Electric smelting plant	Ribeiro Preto, Prov. of Sao Paulo	Compania Electrica Metallurgica Brasileira
BOLIVIA:		
Power plant	La Paz	
Power plant	Tres Cruces	
Power plant (cost of three: \$10,000,000)	Colquenchaca	
†La Paz-Yungas electric railroad	La Paz	Bolivian Government (financed by \$2,400,000 loan made in U. S.)
Electrification of the Corocoro copper mines and city of La Paz	La Paz	Directors Corocoro copper mines
Two electrically operated tramways to connect Oruro and Cochabamba	Mining section of Tres Cruces	
Power and heat	Mining section of Tres Cruces	
Completion of RR. electrification and reconstruction of lines to meter width	Cochabamba-Valparaiso RR.	
Provision for electric power and heat	Mining district of Colquenchaca	
Extension of RR. to Uncia	Mining district of Colquenchaca	
Addition to electric line known as Cochabamba, Vinto, Cliza tramway	Cochabamba	La Sociedad de Luz y Fuerza de Cochabamba Co., capitalized at \$2,000,000.
Hydroelectric plant	District of La Paz	The Guggenheims of New York
Installation of a smelting plant run by electricity	District of La Paz	The Guggenheims of New York
Founding of a town and construction of an electric tramway to it	District of La Paz	The Guggenheims of New York
Electrification of all railways in Brazil		Gov. of Brazil

Project	Location	Constructors
PERU:		
†Electric smelter	Oroya	The Cerro de Pasco Copper Corp., Province of Junin
Provision for electric power for workingmen's homes	Oroya	The Cerro de Pasco Copper Corp., Province of Junin
20,000-kw. hydroelectric plant connection, vanadium ore reducing plant	25 mi. from Jumasha	Vanadium Corp. of America
Electric lighting plant	Portoviejo	Municipality of Portoviejo
CHILE:		
Electrification of Santiago to Valparaiso railroad. (Cost \$10,000,000) (\$35,000,000 Gov. loan for entire electric development)	Chile	Government of Chile
100,000 hp. plant for supply lighting and power	Dist. of Valparaiso	Anglo-Chileno-Americano
Electrification of RR. at cost of \$7,500,000 and erection of power plant	Antofagasta-La Paz Railway	British owners
COLOMBIA:		
Power plant	Near the Neusa Riv.	Power company in Zipaquirá
Construction of locks to provide lighting for El Espinal, Guamo and El Chicoral	La Bolso near Espinal	Irrigation interests in Tolima
Harnessing the Caroni Falls to provide power for new electric railway	San Felix on the Orinoco to the Guasipati gold fields.	

*Dr. Julius Klein, the United States Commercial Attache to the Argentine Republic, says that power plants could well be established near Salta in the northwest, near Iguazu, and in the Rio Negro district, to serve Bahia Blanca of the southeast, and that there will be a great demand for electric power for supplying the various railroads which contemplate the electrification of their lines. At the present time the Argentine railways use three-fourths of the coal consumed in Argentina.

†Now under construction.

Engineering Products Company Established —

J. A. Kinkead and C. W. Hunt, Jr., announce the opening of the offices of the Engineering Products Company in the Rialto Building, San Francisco. This company is Pacific Coast agent for Penn Iron & Steel Co.; Falls Hollow Staybolt Co.; J. Faissler Manufacturing Co.; Lovekin Pipe Expanding & Flanging Machine Co.; Hunter Saw & Machine Co.; Seminole Chemical Co., Inc.; Wm. V. Dee Co.; Hobbs Chain Co. and the Key Boiler Equipment Co., as well as exclusive agent in northern California for Collins & Webb, Los Angeles.

3,000-hp. Synchronous Motor —

The Ridgway Dynamo & Engine Company of Ridgway, Pa., have built what is thought to be the largest synchronous motor yet manufactured. This motor is rated at 3,000 hp. and wound for 2,200 volts, 60 cycles, 3-phase. It was furnished the Canadian Copper Company at Copper Cliff, Ontario, Canada, and is direct connected to a Ratteau Smoot Blower. Several other motors of this rating have been sold to South American mining companies.

Transfer of Washing Machine Company —

The assets and good-will of the Blue Bird Manufacturing Company have recently been purchased by the Davis Sewing Machine Company of Dayton, Ohio, who will continue the manufacturing and sale of the Blue Bird Electric Clothes Washer. As far as possible the old Blue Bird distributors will be retained.



DIARY OF AN OLD-FASHIONED FARMER'S WIFE

2:30 a.m. Dream of electrically operated farm. Peace.

MORE ELECTRICITY NEEDED ON THE FARM

NEW ELECTRICAL DEVELOPMENTS

(The complete electrification of a shingle and cedar siding mill, increased capacity of a power company and plans for a six million dollar terminal at Seattle show the industrial activities of the Pacific Northwest. The Pacific Central district reports unusual activity along industrial building lines with a large number of power company bond issues for new construction work. The organization of a new power company, road work and the contract awarded for a new irrigation district are some of the notes from the Intermountain and Pacific Southwest districts. —The Editor.)

THE PACIFIC NORTHWEST

LA CENTER, WASH.—The installation of an electric lighting system is contemplated for the town of La Center.

DEER PARK, WASH.—The Little Spokane Power & Light Company has changed its name to The Mount Spokane Power Company, and has increased the capital stock of the company to \$100,000.

GRANTS PASS, ORE.—Application to construct a dam 85 feet in height at an estimated cost of \$100,000, for the irrigation of 1,240 acres, has been filed by the Country Club Orchard Company.

BURNS, ORE.—Louis C. Kelsey, consulting engineer of Portland, Ore., and Nampa, Idaho, has completed plans for a municipal lighting plant for the city of Burns. The plant is estimated to cost \$53,127.63.

PORTLAND, ORE.—Fire in the Cazadero hydroelectric plant of the Portland Railway, Light & Power Company recently destroyed two generators, oil switches and other equipment, with a damage amounting to \$6,000.

THE DALLES, ORE.—This city has recently awarded to R. A. Twiss of The Dalles a contract for an ornamental street lighting system. Each light will be supported by an ornamental pressed steel pole, lights to be of 300 candle-power.

SEATTLE, WASH.—The Pacific Coast Coal Company has petitioned the King County Commissioners for permission to erect poles and wires to carry 13,000 volts of electricity from its Hyde mines to its Black Diamond mines.

PORTLAND, ORE.—The Portland Railway, Light & Power Company will construct a \$4,000 temporary sub-station to take the place of its Northern Hill sub-station, which was destroyed by fire last spring. A permanent structure to cost \$35,000 will be built at a later date.

OLYMPIA, WASH.—The capitol commission has awarded the contract for Class B electric fixtures for the temple of justice, insurance building and power house, to H. E. Gleason and Company of Seattle. Final award of the remaining contract for Class A fixtures was postponed for further consideration.

PORTLAND, ORE.—Application for permit to develop power on the Deschutes River in Oregon has been made by the Columbia Valley Power Company, with headquarters at 28 Nassau street, New York City. Robert O. Hayward is president of the company. The application asks permission to develop power for manufacturing and irrigation purposes.

PORTLAND, ORE.—Electrical display signs, long recognized as prime advertising requisites, are now to be used in Portland for inducing sinners to come to church. The First Congregational Church has applied to the council for permission to erect an electrical sign at Park and Madison streets, the sign to be 11 feet by 9 inches, and of approved type.

TACOMA, WASH.—The city council, when it recently eliminated the provision of a franchise with the Tacoma Railway & Power Company, which provided that the city of Tacoma should furnish lighting service to power patrons of the company at the same rate charged city power patrons, placed all power users of lighting service on an equal basis in the city.

NEW WESTMINSTER, B. C.—The city council will decide at an early date whether the city will build a municipal gas plant, or offer some inducements to the Vancouver Gas Company, or the British Columbia Electric Company, to erect a plant. A bond issue of \$60,000 was voted at one time for this purpose, but the fund was used during the war years for urgent local improvements.

SALEM, ORE.—The Nibley-Minnaygh Lumber Company, a Wallowa corporation, asks for a permit from the state engineer to divert 300 sec.-ft. of water from Wallowa river, for generating electric power for the operation of a sawmill, a planer and a lighting plant. A dam of rock and earth, with spillway, timber head-gate, main ditch and flume 4400 ft. long will cost \$15,000.

SEATTLE, WASH.—Replying to Mayor Hugh M. Caldwell's request that an oil tanker be assigned to bring fuel oil from California, for use of the Lake Union power plant of the Seattle municipal system, Admiral Benson states that the Shipping Board will do all possible to provide a vessel. Recent early rains have saved the Lake Union plant to a great extent, and delivery of the oil may be postponed with serious effect.

SEATTLE, WASH.—Construction of a \$6,000,000 ocean terminal for the Pacific Steamship Company on the 26-acre site of the former Skinner & Eddy yard No. 2 has been taken under consideration by the United States Shipping Board, owner of the property. Plans call for the construction of three 1000-ft. piers and a five-story steel and concrete warehouse and office building. The terminal will have a capacity of 325,000 tons of cargo.

RIDGEFIELD, WASH.—The shingle and cedar siding plant of the Bratlie Bros. Mill Company in this city has been completed, at a cost of \$200,000. The plant is electrically operated throughout, each machine having its individual motor. The power house equipment consists of three 72 x 18 high-pressure boilers and a large Allis-Chalmers steam turbine of the Parsons type, direct connected to a generator capable of producing 1,000 horsepower. J. L. Bratlie is superintendent of the plant.

BANDON, ORE.—The Bandon Power Company, as a step in the movement for larger capacity power and electric plant at Bandon, with a dam on Willow Creek, and a transmission line of 20-odd miles to Bandon, has offered to the city its entire plant, including buildings, distribution system and machinery, for the sum of \$35,000. Engineers have estimated the probable cost of the new system at \$105,000, including the power company's holdings at a price of \$25,000. The city has appointed an appraising board to fix the value of the present plant.

ROSEBURG, ORE.—A suit for mortgage foreclosure against the Umpqua Water, Light and Power Company was filed recently in the federal court by A. C. Chumasero and Anna McNabb Burton, two bondholders holding approximately \$76,000 of the company's bonds. Co-defendants with the Umpqua corporation are the Douglas County Light & Water Company, the Merchants Savings & Trust Company, the Merchants Investment & Trust Company, the Commercial Trust

& Savings Bank and the Security Savings & Trust Company, all of whom claim interest in the Umpqua corporation.

TACOMA, WASH.—In a report to the city council by City Light Commissioner Ira S. Davisson, it is stated that the net revenues for the city light department for the first nine months of 1920 exceeded those of the entire year of 1919. The light department, it is stated, is now running about \$21,000 above the record of 1919 in gross monthly income. While the sale of current for the first nine months did not reach the gross receipts of 1919 by about \$113,000, the operating expenses are very little higher for the greater volume of business done, and the net result is a greater amount available for redemption of bonds and improvements.

THE PACIFIC CENTRAL DISTRICT

SAN FRANCISCO, CAL.—The latest addition to the list of California public utility companies is the Nevada California Electric Corporation. This concern, which has \$12,000,000 of its bonds in the hands of the public, has been previously financed through New York and Denver bankers. It is now putting out a \$1,500,000 issue, the greater part of which will be placed locally by Blyth, Witter & Co. The Nevada California Electric Corporation is an 80 per cent hydroelectric concern and operates in Nevada and California. It has the distinction of operating the longest transmission line in the world.

RIVERSIDE, CAL.—Returns of Riverside citrus growers for the season of 1918-1919 just closed are estimated at \$5,310,000. There were 2830 cars shipped. The crop for the coming season is estimated at about 4000 cars.

FRESNO, CAL.—The California Associated Raisin Company is planning to build offices on its ten-acre tract, to cost approximately \$150,000. It is also reported that the California Peach and Fig Growers will build on the same plot.

MARTINEZ, CAL.—Articles of incorporation of G. W. McNear, Inc., were filed recently with County Clerk J. H. Wells. The firm is capitalized at \$1,000,000 and is incorporated for 50 years with its principal place of business and other facilities.

VALLEJO, CAL.—An optical plant, at which all work on optical instruments of the Pacific Fleet will be done, is to be established at the Mare Island Navy Yard. This is according to Lieutenant Charles Swanberg, who has arrived from the Washington shipyards to take charge of the plant.

SAN FRANCISCO, CAL.—Great Western Power Company of California has applied to the Railroad Commission for an order authorizing the sale of \$1,500,000 of general mortgage bonds, the proceeds to be used to reimburse the company's treasury for construction expenditures in connection with its hydroelectric development projects.

PETALUMA, CAL.—This city having requested it, the Railroad Commission ordered the dismissal of the city's complaint against the Petaluma Power and Water Company which was filed in the face of impending water shortage. The city alleged that the company was not using due diligence in its efforts to meet demands for water.

FRESNO, CAL.—San Joaquin Light & Power Corporation has been authorized by the Railroad Commission to execute a trust agreement securing the payment of \$2,625,000 of collateral trust bonds.

SAN FRANCISCO, CAL.—The San Francisco Mint jumped a lapse of fifty-two years in efficiency when the newly installed Rennerfeldt electric furnace began operation November 9. This huge electric furnace is a drum-like metal ball fed on either side by two huge electrodes and a third entering from the top, meeting in the center and maintaining a constant high temperature sufficient to melt the rough bars of silver, gold or copper.

CHICO, CAL.—That the best means by which the municipalities may bring cheap power for municipal purposes to realization is to be found in the appropriation of undeveloped sites in the Sierra Nevada Mountains and the construction of hydroelectric power plants, is the claim advanced at the California League of Municipalities in session here November 9. The speaker was C. F. Scattergood, city engineer of Los Angeles. Some 500 delegates were in attendance at this twenty-second convention of the association.

SANTA CRUZ, CAL.—An order issued by the Railroad Commission authorizes the Boulder Creek Electric Light and Water Company, which operates in Santa Cruz county, to take over the properties of the Mountain Light and Water Company, which serves contiguous territory. The order provides for the issuance by the Boulder company of \$50,000 of bonds and \$5,000 of stock to the Mountain company in payment for the system. The appraised value of the properties involved in the transaction is given as \$61,285.02.

SAN FRANCISCO, CAL.—Declaring that California is at the gateway of enormous possibilities, but that it will not reach the peak of development unless its natural resources are carefully fostered and utilized, the California State Railroad Commission, in a letter to Governor William D. Stephens transmitting its annual report, urges a survey of the state's water and power resources. Referring to hydroelectric power development now under way, the Commission expresses the belief that "as a result of this activity California will never again face the serious situation created by the 1919-1920 combination of extraordinary demand with minimum supply." In this connection it is urged that "steps be taken immediately whereby a complete investigation of all hydroelectric power possibilities and water storage possibilities, for irrigation and other purposes, be made in detail and such legislative action taken as will give to the Commission complete jurisdiction to direct the power developments in the state so that the most good to be public will be had."

THE PACIFIC SOUTHWEST

LOS ANGELES, CAL.—Pacific Electric Railway Company has applied to the Railroad Commission for authority to abandon and remove a spur track near Maxson Station, Covina line, Los Angeles county. The track was built to serve the Whittier Land and Water Company pumping plant when it used oil as fuel. The pumping plant is now operated by electricity.

SANTA FE, NEW MEX.—The application of the City Electric Company of Albuquerque for a franchise to build electric lines and for rights-of-way along practically every main road in Bernalillo county has been refused, with the exception of the proposed interurban line from Albuquerque to Alameda. This will be granted if the company will accept certain imposed conditions.

LOS ANGELES, CAL.—The Ontario Power Company, San Bernardino county, has applied to the Railroad Commission for authority to issue and sell \$38,000 par value of its 7 per cent preferred stock at par. The proceeds are to be

used to reimburse the company's treasury for construction and other expenditures and to purchase what is known as the Base Line Road pole line from the Southern California Edison Company.

LOS ANGELES, CAL.—Declaring that the present rates are non-compensatory, the Railroad Commission has authorized the Pasadena Electric Express Company to put into effect a new schedule of charges for service between Los Angeles, South Pasadena, Alhambra and Pasadena. The new rates are approximately 25 per cent higher and the schedules segregate and provide different charges for pick-up and delivery service.

LOS ANGELES, CAL.—Reconstruction work which is expected to soon provide ample electricity for the entire valley and reduce the local power difficulties has been started on the gas-electric plant of the Holton Power Company. Frederick Stiefel, construction expert of the Allis-Chalmers Company, will rebuild the 1000-hp. gas engine plant and restore it to the rated capacity. The Holton Power Company is planning to spend \$10,000 on the work.

LOS ANGELES, CAL.—Frederick C. Rockwell, heading a syndicate which has applied at Salt Lake City for water rights for irrigation purposes for 100,000 acres in Kane county, Utah, has intimated that this application may be regarded as preliminary to other applications to cover greater acreages in the Utah counties bordering Arizona. Interested financially with Mr. Rockwell in the reclamation undertaking, he says, is ample capital, a majority of it from Phoenix, Arizona, and vicinity.

RAY, ARIZ.—Enough power could be developed at the San Carlos irrigation project to meet every mining need of the Ray-Hayden district, Ralph Cameron said in a speech in Ray recently. He told of a proposal for a dam and power plant on the Colorado river. He further said: "This power plant will generate 965,000 kilowatts of electricity. Mines of Arizona do not consume more than 150,000 kilowatts. The railroads will use 200,000 kilowatts, while the remaining 615,000 can be used by pumping plants furnishing water to irrigate crops on land now unproductive."

LOS ANGELES, CAL.—The Southern Sierras Power Company, which operates in the counties of Inyo, Kern, San Bernardino, Riverside and Imperial, has applied to the Railroad Commission for an order authorizing the issue of \$1,040,478.55 first and refunding mortgage gold bonds. The proceeds are to be used to reimburse the company's treasury for moneys expended from income for extensions and improvements. The company also asks for authority to issue \$444,260.80 first and refunding mortgage gold bonds, this amount representing 85 per cent of the cost of extensions, additions and betterments made since December 31, 1918.

THE INTER-MOUNTAIN DISTRICT

PARK CITY, UTAH.—The Keystone Mining Company is constructing a mill in Park City which will be electrically operated and will use approximately 500 horsepower.

PARK CITY, UTAH.—The Glen Allen Mining Company is building a mill which will be in service about January 1, 1921, and will be electrically operated. This mill will require about 300 horsepower.

SALT LAKE CITY, UTAH.—Cooperation of local engineering societies will be asked in working out a suitable accounting system in the handling of applications, preliminary permits, licenses and other business matters of the newly organized federal water power commission.

SALT LAKE CITY, UTAH.—The contract for digging the feed canal which will convey water from the Jordan river to the proposed power plant of the Bonneville irrigation district, has been awarded, and plans are now being gone over in detail in connection with the disposition

of the \$600,000 bond issue which was recently voted by the property owners in the district.

HAXTUN, COLO.—Plans are being made to build an extensive addition to its light and power plant, which is owned by the city. The present plant is too small to properly supply the needs of the fast growing town. It is planned to have the new building completed and equipment in operation by the first of the year.

SALT LAKE CITY, UTAH.—The extension of Salt Lake City's "whiteway" to State street from South Temple to Fourth, South; on Third South street, from West Temple to Second East, and on Fourth South street from State to Main is practically assured by reason of the fact that the city commission has instructed the city recorder to advertise for bids for installation of the necessary lighting system.

SALT LAKE CITY, UTAH.—The Provo Reservoir Company has installed the first unit of their electrically operated pumping plant to pump water from the Jordan river against a head of 250 feet into the Provo Reservoir Company's canal which irrigates the southwestern part of Salt Lake county. The initial installation is 800 horsepower. Their ultimate requirements will probably be in the neighborhood of 4,000 horsepower.

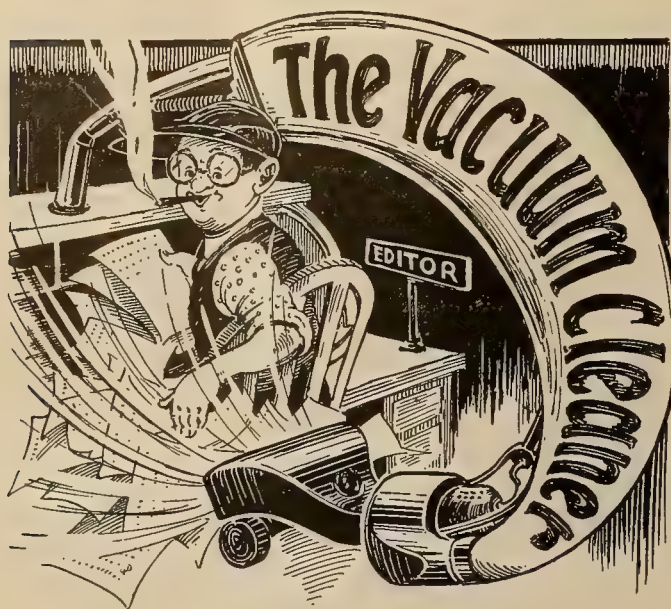
OURAY, COLO.—The Loyal Mining and Milling Company, operating the Mickey Breen properties up Poughkeepsie gulch, has been fully capitalized and Thos. P. Michell, manager of the property, is arranging to have a power line run to the mine, with a view to installing power machinery at once, if the weather permits; if not, development work will be continued by hand until spring, when the power installation will surely be made.

SALT LAKE CITY, UTAH.—Land totaling several thousand acres, included in power reserves of the intermountain country, will be thrown open to entry under the public land laws, federal officials declare, as a result of a decision of the federal water power commission. The decision provides that where land reserved for power sites will not as a result be injured or destroyed for purposes of power development, it shall be declared open to entry.

WOLF POINT, MONT.—Organization of the Listerud Power Company of Wolf Point, Mont., was recently completed and the company incorporated. The new firm will take over the business of the Wolf Point Light and Power Company. The officials are: O. C. Johnson, president; S. T. Coggsell, vice-president; M. B. Listerud, treasurer, and H. A. Shoenig, secretary. With C. P. Swedborg they constitute the board of directors. Mr. Listerud will be the general manager. The concern is capitalized at \$100,000.

SALT LAKE CITY, UTAH.—Considerable road paving work has been done during the past summer, and is being finished this fall, between Salt Lake City and Ogden, on the north, and between Salt Lake City and Provo, to the south. Practically all of the various contractors handling this work are using electric power, for pumping purposes, for their rock crushers, elevating machinery and mixing plants. Many of these contractors formerly used steam or gasoline for such work, but have concluded that electric power is more practical and more economical.

GREAT FALLS, MONT.—Investigation of power plants, equipment, methods of distribution and other ideas utilized at the falls of the Missouri river near Great Falls, is being undertaken by J. F. Mahl, an engineer from Berne, Switzerland, who is studying methods and conditions in the Rockies with a view of utilizing them in harnessing Alpine streams and deriving electric power. Switzerland is planning to utilize all of the water power available in that country, and has sent several representatives to the United States to investigate the methods used in power plants throughout this country.



CURRENT FICTION

1. In Conversation:

"I called you up three times and they said you didn't answer."

"I never did that when I was a boy."

"The baby said 'Papa' quite distinctly yesterday."

"The country is going to the dogs."

"This is the wettest October we've had in thirty years."

"Something is bound to happen."

"We'd be delighted to see you any time you care to drop in."

"It makes no difference to me personally, but——"

2. In Print:

"This is a turning-point in the history of the world."

"One of the most popular of the city's younger set."

"Details of graft plot bared."

"The most momentous question ever submitted to the people of the nation."

"The hit of the season."

"... ushers in a new era."

* * *

Ideas of heaven vary with the individual; likewise ideas of the summit of success and the pinnacle of pleasure. For instance, a circular recently issued by a "write-moving-picture-scenarios" concern reads as follows:

"WORKING GIRL RECEIVES \$10,000 FOR ONE IDEA

Quits Work—Lives in Ease
Gets Ten Proposals to Wed First Day
Offered Free Rides by Auto Salesmen
Importuned by Agents"

And it is not intended as a warning, but as an inducement to go and do likewise. Verily, there is no accounting for tastes.

* * *

A "Safety Valve Club" has been formed among a group of Eastern engineers, according to a recent report. The object of the club is to cultivate the art of public speaking. Debates will be held, and at the close of each meeting in "friendly criticism of each other's delivery, mannerisms or attitude, if these show very marked defects."

Personally we should say it would be somewhat difficult to maintain a "friendly" atmosphere during a series of remarks like this:

"Mr. Blank has a habit of turning in his toes and blinking his eyes rapidly whenever he is approaching a climax."

"Mr. Ex stutters when he gets excited. Also during his speech this evening he said 'those kind of transformers' and 'he don't'—both grammatically incorrect."

"I notice that Mr. Wy keeps his hands in his pockets throughout his speech and rises on his toes at the beginning of every sentence. Also, in spite of the fact that he is bald, he shakes his head at intervals as though he were throwing his hair out of his eyes."

The club meetings may work out excellently, of course, but we cannot help being reminded of a certain admonition we read recently:

"When a man has had his nose broken in three places he should stay away from those places."

Also we don't think the word "Safety" is especially appropriate in the title of the club.

* * *

A contribution to epigrams of the industry is:

"You are not a live wire merely because you sputter."

* * *

Necessity is the mother of invention in sport as well as in business. In a colored baseball game the pitches had gone rather wild, and had permitted all the bases to fill. Another man came to the bat, and the nervous pitcher shot one over.

"Ball one," yelled the umpire.

The pitcher tried again.

"Ball two," was the decision.

Another effort by the hurler.

"Ball three," said the umpire.

The pitcher saw his predicament and made one master effort to save the day.

"Ball four," yelled the umpire, "and the man's out."

"How come, I'se out?" inquired the enraged batter.

"I'se repelled to put you out, nigger. Don't you see dar's nowhere else to put you?" reasoned the umpire.

* * *



ELECTRICAL HYBRIDS — II

The Electric Fantelope

The Fantelope is rather cool—
And does not like hot air;
He's proud because he runs so fast
And has no time to spare.

IN THIS ISSUE: Electric Welding Aids Western Industry

SAN FRANCISCO
PUBLIC LIBRARY

JOURNAL OF ELECTRICITY

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SAN FRANCISCO, DECEMBER 1, 1920

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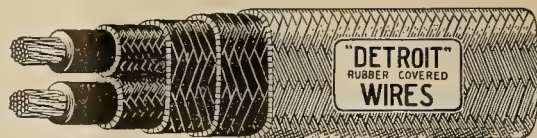
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JOURNAL OF ELECTRICITY

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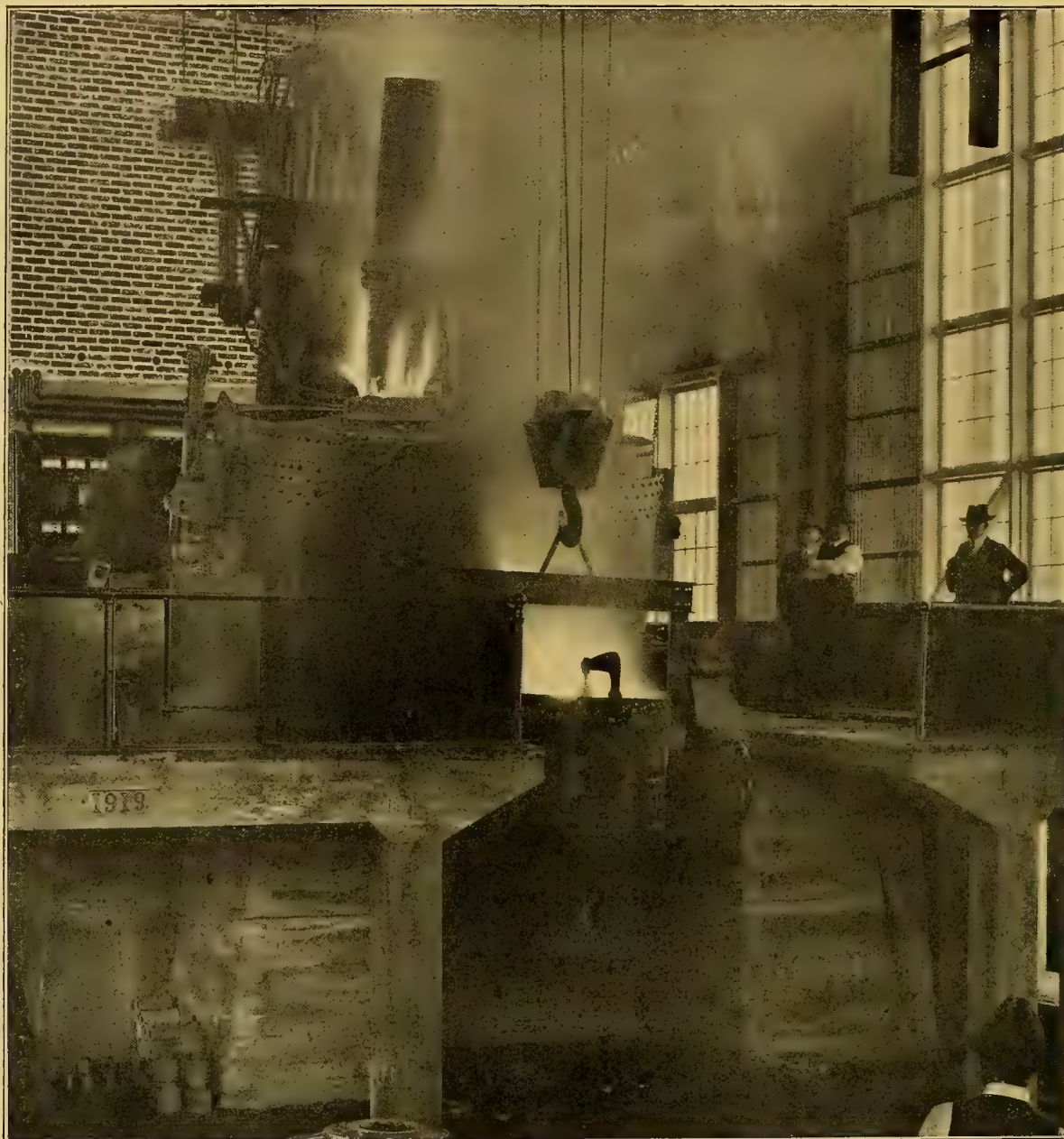
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THE ELECTRICAL TRIO:

ELECTRICAL WORLD — JOURNAL OF ELECTRICITY — ELECTRICAL MERCHANDISING

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A Growing Factor in Western Industrial Development

TO DATE it is possible to count the installations of electric furnaces west of the Rocky Mountains, but the advantages alike to the power company in the large blocks of power involved, and to the user in the purity and cheapness of the resulting product are beginning to be felt in the mounting interest shown in this field. The furnace here shown is of the 6-ton Heroult type in successful operation in the shops of the Southern Pacific Company at Sacramento, California. The satisfactory

record of steel thus produced during the first month at 4½¢. per lb. including all overhead and with high prices on material, at the same time maintaining a very high quality of output, compares most favorably with other methods of steel production. Steel furnaces utilizing iron scrap rather than pig iron on which high freight rates must be paid, are the natural development for the West and there are tremendous possibilities in Western metal industries along this line.



JOURNAL OF ELECTRICITY



DEVOTED TO THE UPBUILDING OF THE ELECTRICAL INDUSTRY IN THE WEST
AND IN THE COUNTRIES BORDERING THE GREAT PACIFIC

Volume 45

SAN FRANCISCO, DECEMBER 1, 1920

Number 11

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THE NEED OF CONFIDENCE

THE confidence of the people of the West in their public utilities must not be shaken. These servant industries of the people have construction plans that run into the hundreds of millions of dollars to be expended in the next few years, and upon the carrying out to successful completion of these plans depends the industrial upbuilding of the West. This point was brought out in a recent speech by E. O. Edgerton, president of the California State Railroad Commission, before the League of California Municipalities in which he said, "It must be clearly understood that if California is to progress industrially, there must be an immense increase in the facilities of the companies performing public utility service. Expressed in terms of money, it will mean several hundred million dollars in the next few years. It must be admitted that there is no power to force investment in the securities of these companies, and sound policy becomes of vital importance in an assurance to the investor that his investment will be dealt with fairly and intelligently, else he will refuse to come in, and progress in the development of California will be seriously retarded. . . . You who are the official representatives of municipalities have a very serious responsibility. It is your obligation when you advise your constituents on pub-

lic utility matters not only to state the facts as you are informed, but that you fully inform yourselves before attempting to speak. It is important that you do not by misstatement, either purposely or ignorantly, shake the confidence of the public in so important a matter as the regulation of public utilities."

It must be admitted that there are advocates of public ownership who misrepresent the facts concerning the operation of publicly owned and privately owned public utilities so that the epithets of "grafting" and "soulless" have in the past been applied to the public corporations. Years ago these epithets may have held true, but in this day of commission regulation and a determined effort on the part of the public utilities to render service with their commodity, such a thing can not exist.

The great industries of the West of which the power companies are an important part must not be held back in their program of construction, and for that reason the electrical industry as a whole must present a solid front against these attacks, keep the confidence of the people in these power companies so they will be willing to support them financially in carrying on their development of natural resources, thus insuring the industrial progress of the West.

With renewed interest in electric ranges as one of the elements of the relieved power shortage, the question of a service policy in this field is again to the fore. That the power company should give service on this equipment is unquestioned, but there is a tendency at present to take the stand that the customer should be asked to pay the cost of replacements where these are not excessive or do not spring from defective parts. Experience of some of the Western companies has been that such bills, if dictated by a not unliberal policy, are met with perfect willingness on the part of the consumer, who has not expected to get more than he pays for. The necessity for some such charge is obvious when the problem comes up of what shall be done for a consumer who moves into a territory with a range already purchased elsewhere and requests service, a situation which is becoming more and more frequent.

There are other dangers involved in a too paternal policy in the marketing of the electric range. One housewife who answered for the third time a call from the company's man inquiring if her range was satisfactory asked, "What's wrong with this range, anyway? You all seem terribly afraid it won't

work." It is a question whether cook books instructing the new owner how to cook dainty dishes electrically do not suggest that this is a strange art rather than merely a more convenient and more satisfactory way of doing what she has always done.

The experience of the past few years which has shown that ranges can be sold on their own merits, even at high prices and without further advertising on the part of the companies, who have on the whole avoided rather than encouraged this business, would indicate that the range field is no longer in a state of experimentation and no longer requires the special inducements of the introductory period. It is time that the electric range stood on its own feet, with an adequate rate which is fairly comparable with the costs of gas and coal for similar use and with a service policy which, though liberal, presumes that the customer will gladly pay his own way.



Do you never see your wife at the breakfast table?

MAKE IT AN ELECTRICAL CHRISTMAS
WITH A WAFFLE IRON



AIRPLANE FOR LUMBER COMPANY USE

In view of the importance of the airplane in surveying and cruising for lumber companies over areas made almost inaccessible by the dense underbrush, as well as in guarding against fires, the accompanying picture taken from an airplane for the Snoqualmie Falls Lumber Company near Seattle, Washington, is of special interest as showing the clear definition of the wooded areas and habitations. The picture is a unique view of both the lumber company's plant, shown in the background, and the beautiful Snoqualmie Falls plants of the Puget Sound Power and Light Company in the foreground. The entrance to the shaft leading to the cavity plant which is hollowed out of solid granite 220 ft. underground, is located just to the left of the white buildings above the falls. The spurt of white water to the right of the falls indicates the mouth of the tunnel which serves as tail race. The photograph is copyrighted by the Cress-Dale Photo Company.

Demands for certain of the materials needed by modern industry can only be supplied by the electric furnace, which has become an essential tool in the hands of the up-to-date metallurgist. To a large extent progress has become a matter of refinement and in the utilization of metals this has become a question of the production of special alloys possessing qualities that fit them for specific uses. Aluminum can, for instance, only be produced by the electrolysis of a fused bath of its salts, and in a practical way this requires an electric furnace consuming large quantities of power. The price of the product is dependent upon the cost of power, but whatever the price, aluminum has become an essential industrial material. But we are not satisfied to use aluminum in a pure form; its fitness for certain uses can be improved by alloying with copper, magnesium and other metals; thus for the pistons of automobile engines aluminum alloys are used, a superior piston is obtained, both from the point of lightness and durability, with the result that the product is essentially cheaper, both in first cost and in the long run.

In the field of ferrous alloys, the electric furnace is essential from the point of purity of the product. Often the electric furnace is the only means of producing these alloys, and in some cases by its use a cheaper product is obtained. Manganese steel can be produced more cheaply in the electric furnace than by other means and the product so obtained is superior in quality. In the non-ferrous alloy field, the use of the electric furnace is increasing rapidly; a larger quantity of metal can be poured in one heat, as a more uniform product results, and there is an important saving in the alloying metal. To illustrate: brass, an alloy of copper and zinc, was formerly made entirely in crucible furnaces, the quantity melted was at the most a few hundred pounds, there was a loss of zinc which added to the cost; but using an electric furnace several thousand pounds can be produced in one melt and the loss of zinc is small, in good operation less than two per cent. Most important, with a reasonable power cost, the price per pound is less than with a crucible furnace.

There are but few electric furnace installations on the Pacific Coast. This is possibly due to a lack of knowledge of the advantages both in quality of product and in the lessened cost of production that can be obtained by their use. Electrical development in the West is making rapid strides; with a full appreciation of the economy to be obtained, progress in development and use of the electric furnace is sure to come and the West will do its part in the worldwide effort to make good metal better.

Under the leadership of the Public Policy Committee of the Northwest Electric Light and Power

A Joint Utility Campaign

Association for Oregon, plans have been made for the working out of a joint public utility organization of that state which shall not only deal with questions of public relationships as necessity for such action arises, but shall take the lead in formulating public opinion in relation to public utility questions. This organization is to include water and gas corporations as well as electric companies and is modeled after similar bodies which have done good work in some of the Eastern states.

The idea back of this movement is that public utility interests should not wait for a destructive force to grow up against them in the community and then combat that force, but should mold public opinion by constructive advertising. This is a forward move. There has been much talk of the need for action and there have been occasional good-will campaigns on the part of individual companies, but on the whole nothing adequate has come of it. It was interesting to note in a recent electrical convention held in the West how every discussion, whether started on the subject of accounting or the problem of inductive interference, managed to end somehow in the importance of maintaining friendly relations with the public. The public utilities of Oregon evidently propose to do something besides discuss the subject.

There has been a good deal of talk about the transition from a seller's to a buyer's market and the effect which it is going to have upon industry in general.

Selling a Buyer's Market

It now looks as though such a change has taken place already, and that every manufacturer, jobber and retailer is now right up against the proposition of **selling** his products rather than of taking orders for them. In other words, we have all of us got to become salesmen instead of order takers. The good old days of selling are with us again, and this means in many cases an entire revision of merchandising plans.

Of very far-reaching importance in future merchandising plans must be the matter of advertising and advertising copy. While in a great many cases the advertising appropriation must be increased in order to enable the manufacturer or distributor to put over the real sales message, there are many other cases where the proper conservation of the present advertising appropriation and the spending of it in real mediums to the best possible advantage will be sufficient without any increase. Many concerns have been frittering away their advertising appropriations by a little ad here and a little ad there, whereas the concentration of their advertising in a few mediums would make them look like big advertisers and get them very much better results.

No house is too big to be immune from the loss of trade during the present situation, and wise, constructive, confidence breathing merchandising and selling methods will yield more profits later than immediate fat orders. The manufacturer who gets healthy orders today must recognize that the sale of his product depends first of all on business conditions beyond his control; secondly, on the ability of his buyers to adapt their businesses to fundamental economic conditions; and thirdly upon the skill of the

manufacturer's advertising and sales department in creating a desire for his particular product.

As Mr. Lewis said in a recent address before the Associated Business Papers, "Mr. Manufacturer has got to quit looking out at the world through his factory windows and stop accepting second-hand opinions from prejudiced observers regarding market conditions." This means that the manufacturer or the distributor must determine for himself what are the conditions surrounding the sale of his product, and then apply the remedy in the shape of better merchandising methods and a business-like use of his advertising appropriation.

Outdistanced only by the electric furnace is the rise of electric welding in modern industrial activity.

The Rise of Electric Welding

It is now a well known fact that electric welding played a vital part in rehabilitating the German ships dismantled in American ports during the war period, thus expediting the transportation of troops to Europe and bringing about the successful consummation of the war. In the building of the merchant marine, too, in the various shipyards of the country, the applications of electric welding are constantly increasing in number. For some time past electric welding has been used in the building of ships in the equipment having to do with the ladders, uptakes, flanges and deck fittings, but its use in structural parts or floating equipment has been very limited. On another page of this issue of the Journal of Electricity will be found an interesting account of a new advance in electrical welding accomplishment, involving its use in the construction of the floating equipment of dredgers, the reclaiming of cutters on dredgers, and the riveting of flanges. This replacing of the old riveting methods by electric welding has brought out decided econ-



MONTANA HOLDS FIRST ELECTRICAL SHOW

In the early part of October the first electrical show ever held in Montana was put on by the Montana Power Company in its offices at Butte, with the assistance of the local supply jobbers and dealers. Fifteen thousand people visited the show which was open during the evening to accommodate those who could not visit the exhibition during the day. Full-page advertisements calling attention to the show were run in the daily papers in Butte, and additional publicity was obtained by folders which were mailed to all local consumers. One of the features of the show was the raffling of several electrical prizes consisting of a washing machine, a portable lamp and shade, a vacuum cleaner and a grill, for which tickets were given away to each consumer of the power company. The show was held under the direction of J. Ryan Gaul, commercial manager of the Montana Power Company, and D. J. McGonigle, district sales manager of the Montana Power Company. The effects of this show have been already noted in a greatly increased activity in the sales of electric appliances, and particular attention is being given to these in a series of follow-up suggestions for electrical Christmas gifts. The success of this show has been so marked that there is every likelihood of its being made an annual affair.

omies. It is interesting to note that one suction dredge in California having a suction pipe diameter of twenty-two inches, made of one-half inch plate, has employed the electric welding process since 1912. Not only does this type of welding make for a saving in labor when compared with the riveted method, but the flanges are used time and again on the electric welding process in a way that would be impossible under the former methods. Surely industrial engineers have before them a magnificent new field to stir the imagination in ferreting out new and important applications of electric welding.



NEWSPAPER SUPPORT IN WATER POWER DEVELOPMENT

With construction plans which call for an expenditure of over three-quarter billion dollars in the next ten years, Western power companies have found that both the strength and weakness of their position lies in their dependence upon public support. The justice of the "self-interest" plea, however, as presented both orally and in the technical press, has already found its response in the ready interest of the public and the newspapers of the West have given generous support to the campaign for wider water power development. Such cartoons as the one shown above, which appeared recently in the Oakland Tribune of Oakland, California, help to lay the firmest foundations for later bond issues to finance hydroelectric projects.

That the gigantic power development schedule of the West has attracted nation-wide attention, is best evidenced by the fact that a number of hydroelectric securities from outside districts are now being put upon the markets of California and the other states of this region. This comes as a great compliment to the forward-looking people who dwell in this district; at the same time citizens might well bear in mind the fact that securities of this nature vary in different states. Those issuing securities elsewhere have not reached the same high stage of development as similar enterprises in the West, and often have not the same type of regulation behind them to ensure equal permanence to their securities. As a consequence, people of California and other states of the West would do well to investigate carefully when purchasing securities unknown to this district.

The Question of Outside Securities

There is also the problem of local self-interest; the West needs its own moneys for its own development. This factor should rightfully have a deterrent effect in the promotion of so-called foreign securities or securities of other states of the Union beyond the Rockies, that are being marketed in the West.

This old world of ours, torn with dissension as the result of the greatest war of history, is now about to enter its third period. First came the conflict with its awful loss of life and property, then followed a desperate period of rehabilitation, and now business effort pauses a moment to enter upon the third and last era in the cycle. Prodigal spending to save the nation during the conflict passed with the signing of the armistice. Stifling profiteering immediately following this, and while the nation was struggling to regain its balance, is now passing, and we enter a period of sane, sound and constructive thinking.

The Big Idea

The world has learned much through it all. It has learned a broader sympathy for the other man and his problems. In the new era upon which we are now entering, only those industries and those enterprises will survive which are based upon a fundamental service, a service rendered at a reasonable and just cost to the consumer. The electrical industry stands forth best of all to meet the crisis. Its record of expenditures is an open book, its investments are sound and its service basic. With its high ideals held in view, particularly those ideals of Western utility companies brought out in recent utterances of their leaders, no lack of support on the part of the public is to be feared. With this ideal, then, of first establishing a constructive service to the people, and second, of seeing that this ideal of service is carried into operation, the Journal of Electricity again dedicates its pages to the service of industry in seeing to it that the public senses this vision of service, and renders to such service its just due—a fair, reasonable, and indeed a generous treatment.

The West is passing through a very interesting and prosperous period of development. New industries are seeking admission to many quarters of the West. Citizens, particularly those of the electrical industry, may help in this situation by having at hand some information for everyone who comes to them with an inquiry.

How to Get New Industries

The compiling, printing and publishing in every form of every kind of data pertaining to industry in the West should be encouraged. The electrical industry is the basic industry upon which all types of progress in manufacturing must depend. Let men of the electrical industry through their development leagues, through their National Electric Light Association, through their engineering organizations and through their technical and trade magazines devote special attention to the gathering of statistical data

on the industrial possibilities of the West, and it is safe to say that the next ten-year period will witness the most remarkable development ever known in the growth of the West. Let us then, as the new year approaches, make one resolution, and that is that in the months to come we will each and all render a greater service to industry, and champion it throughout the West. Let our news, our advertising, our educational efforts, our inspirational themes, our personal interviews and our research activities visualize industrial possibilities of the West. Thus, and thus alone may the West continue in that type of leadership which through its enthusiasm, vigor, daring, and newness of life has become so fundamental in its traditions.

Hitherto the so-called heavy chemicals, as for instance, caustic soda, soda ash, sodium sulphate, sulphuric and other acids, have been manufactured in large quantities in the West, while these states have had to import from Eastern points the so-called intermediate and refined chemicals. Since the recent raise in freight rates it is interesting to note that chemical industries in the West are manufacturing on a larger scale the chemicals which heretofore have been imported, and a decided impetus is given to those chemical industries already in existence. The Stauffer Chemical Company of Stege, California, has about completed an addition to its plant which will make it a large producer of sulphuric acid and other chemicals. The General Chemical Company at El Segundo near Los Angeles is installing a contact sulphuric acid plant for oleum and this plant will soon be in operation. Some of the refined chemicals which are now being manufactured on the Pacific Coast are sodium hyposulphite, magnesium sulphate, tartaric, buteric, citric and other acids, sodium potassium tartarate, better known as Rochelle salts, and some of the aniline dyes. It would seem, therefore, that the outlook for the West for chemical products, both heavy, intermediate and refined, is unusually bright from the manufacturing viewpoint.

Advertising damaging facts which are true leads to their rectification—the advertising of untruths or of facts so distorted as to convey untruths leads to violence and revolution. If there is any menace of radicalism in this country today it lies in the misunderstandings which are intentionally or unintentionally spread broadcast by agitators and fanatics. There are few people who are wilfully violent without the urge of what they believe to be an intolerable situation—the vast

majority of all classes are unjust only when they are ignorant. Unfortunately the common method of handling the situation at the present time seems to be by means of troops and prison sentences in the assumption that mistakes are rectified in this way. There is more than one instance of a strike, which was a matter of a few well-advertised lies spread by agitators, being fought out to a finish and won by the side in which justice inhered without the mistaken employees ever being disabused of the idea that they were unjustly treated.

Business men have learned the value of advertising—why not apply its magic to the intricacies of the present situation? No lie was ever defeated except by the truth—why not do a little advertising of the truth? The adherents of that radical movement which has become known in America under the loose title of “bolshevist” are possessed of an apostolic enthusiasm which leads to most ambitious campaigns of propaganda. We believe their fundamental idea to be wrong; we know that they have made most unscrupulous use of untruths in the interest of gaining believers. What are we going to do about it? We can put its adherents in prison, we can ship them out of the country—and perhaps both steps are necessary on occasion to curb the immediate problem with which we are faced—but in so doing we have done no more than meet an immediate emergency with methods which must be defended solely on the grounds of expediency. We cannot prevent the untruths and half-truths from working on in the minds of those who can read and who can converse between themselves—that is, we cannot prevent this unless we combat it by spreading the statement of the truth. The true protection against Bolshevism, as against radicalism of all kinds, lies in advertising—the advertising of sanity.

Much has been accomplished in recent months by the California Electrical Cooperative Campaign in its effort to introduce the electrical home idea throughout the West. Great, however, as have been these accomplishments, there is still much to be done. National manufacturers as well as the architect and home builder need to realize more than ever before that only as the convenience outlet is instituted in the home can the uses of electricity be extended. It would be well, then, that in all phases of advertising and every campaign of a selling nature, manufacturers should bear in mind this fundamental point that only as the home builder and the architect learn to include in all new building plans ample convenience outlets can the electrical industry go ahead with full development in the home electrical idea as dreamed of by those who have its best interests at heart.

A New Journal Service

The importance of the news department of a technical paper in keeping its readers in touch with whatever is of interest and importance from their standpoint in world events has led the Journal of Electricity from time to time to enlarge and better this section of its service. With a view to a more comprehensive and authoritative review of significant happenings, a new system of field and market reports is now being worked out and will soon be put into effect which will still further improve the news value of the Journal of Electricity to western industry beyond the scope of any other technical paper now serving this region.

Electric Welding Practice

BY J. H. ANDERTON

(The place of electric welding in industry, especially in the shipbuilding industry, becomes increasingly important. Its development and application are taken up in an article by the chief electrical engineer for Stone & Webster, Inc., of which the following is the first part. The author was also a member of the electric welding committee of the Emergency Fleet Corporation.—The Editor.)

Previous to the great war, all forms of electric welding had been carried on in this country for many years. The most extensive development up to that time was that of spot or butt welding and many of these machines were in use for the assembly of such parts as metal window sash, wire reinforcement for concrete and other similar products. Adaptations of the spot welding idea are found in the butt welding machines for the welding of high speed and expensive tool steels to less expensive shanks, etc. The two forms of arc welding were in use; that is, the carbon arc in which the metal is fed independently into the arc formed by the carbon pencil and the work, and the metal arc process in which the metal pencil itself is deposited in the weld. Of these two latter processes, the carbon arc was and is confined principally to the filling of large castings and similar work. The metal arc process was, however, rapidly becoming recognized as more universally applicable for welding purposes and a large number of our most important railroads were using it extensively for the repairs of locomotive boilers, locomotive frames, cylinders and many other places, some of which could not otherwise have been repaired. Certain shipyards were also using arc welding, mostly confining its uses to places where gas or other welding could not be successfully applied, or where strength of the weld was unimportant.

In 1917 the American Institute of Electrical Engineers, recognizing the increasing importance of electric welding to the industry, organized a sub-committee of the Research Committee for the purpose of investigating possible improvements in the technique and general knowledge of the subject. In March of 1918 the Emergency Fleet Corporation appointed this sub-committee as a special committee to advise the Corporation as to the status of the art with special reference to its application in hastening the steel ship program. This committee held weekly meetings at the Institute headquarters in New York and arranged for visits of Captain Caldwell of the British army to this country for the purpose of explaining methods and the extent of the application in Great Britain. Commander Goodall of the British navy also assisted in this connection.

The results of the labor of this committee was the compilation of a great amount of data pertaining to welding in general and the awakening of an interest, particularly in the shipyards, in it as a method of primary construction worthy of some consideration. Coincident with the shipyard development, various other uses were found in manufacturing lines, and it may be of interest to know that the Liberty Motor is in no small measure indebted to electric arc welding for its success.

The Need for Skilled Welders

It was early recognized by the committee that



The character of a weld is largely dependent upon the skill of the operator. The above picture shows the welding of a dipper pan—a piece of very light work in steel.

one of the primary and most important requisites of good welding was good welders. So much so-called welding had been done by unskilled and untrained workmen that it was difficult to overcome a natural prejudice against electric welding. Statements and test data showing results of welding on plates and other parts having strength characteristics much in excess of riveting were of little avail when one could go aboard a ship or to a shop and knock so-called welds apart by means of a light hammer. A second limitation to the advancement of welding on ship construction was the attitude of Lloyd's Register of Shipping and the American Bureau of Shipping. It must be admitted that steel ships are complex

structures subject to very complex stresses in operation. The attitude assumed, therefore, by the shipping bureaus that they would approve ship construction in which welding was used only after due consultation, was to be expected.

The committee therefore took upon itself the training of electric welders at various centers throughout the country. These men and women were made available to the shipyards as fast as they showed competency. Most of the yards themselves, at the suggestion of the Emergency Fleet Corporation, started schools for this purpose and trained their own operators. The committee was also finally successful in obtaining from the shipping bureaus a list of parts upon which arc welding would be permitted. This list has been extended from time to time to include such other items as knowledge and experience has indicated could be included, so that today any shipyard with the proper equipment for

arc welding and skilled operators may weld hundreds and in some cases thousands of parts in ship construction where bolting and riveting was formerly used, and at a much lower cost.

New Processes and the Shipbuilding Industry

It is doubtful if there is any industry where it is more difficult to introduce new methods, and particularly radical ones, than in shipbuilding. Established methods of successful practice based on a wide experience have become fixed in the art and in the minds of the builders, and the difficulty of establishing new processes which will meet with the approval of the various interests is a very real one. In view of the above, the progress made in the past five years may be considered remarkable and while the greatest attention has been paid to welding as confined to ship construction, present indications are that far greater use will be made of it in other lines of manufacture. For instance, one very important electrical manufacturer is now arc welding transformer tanks 20 feet high by approximately 10 feet in diameter, replacing practically all riveting in the longitudinal and girth joints by V-welds, welding in the bottom to the sides and welding on the bottom stiffening beams, also the oil and water connections with absolute certainty that there will be none of the oil leakage which has heretofore been so troublesome to operators of large transformers. In general, electric welding may be considered to have arrived at a stage where its increased use is dependent upon a more extended or proper distribution of the knowledge required for its application.

Electric Welding Systems

As intimated above, there are two distinct varieties of electric welding successfully developed to be of any practical value to industry today; that is, resistance (butt, line and spot type) and arc welding. As they differ considerably, both in principle and application, a short description of each is given, together with their possibilities of application.

Resistance Welding: By this type of welding it is possible to secure sufficient jointure between lapped surfaces of plates, abutting ends of bars, rods, tubes, etc., of ferrous and non-ferrous materials, by first raising the temperature of the joint to a welding heat (by the passage of a heavy current) and then applying pressure to the joint to cause proper fusion and flow of metal. The process being based on the resistance of an electric conductor, it follows that the temperature rise is greatest at the point of highest resistance within the limits of actual contact. The heating effect is therefore localized at the spot where it is required. This, added to the close regulation of temperature obtainable by controlling the current flow, gives excellent results. Butt welders operating on the above principle are used for the welding of rods, tubes, bars, etc., such as shafting, machine tools, and many other applications. Line welders have been used to a limited extent for the making of continuous welds on lapped plates of comparatively thin metal.

Spot welders have many applications. With this type of machine, lapped edges are introduced be-

tween the points of two electrodes which form the terminals of a circuit. For alternating current spot welders the transformer is usually made a part of the machine and it thus becomes portable. For direct current the heavy leads must be connected to it and it is therefore practically fixed to a definite location. In operation, the circuit is closed by the plates or other metal to be welded and the contact resistance causes a rapid rise of temperature at and adjacent to the spot. When the proper temperature is reached, the current is interrupted and pressure applied simultaneously, causing a localized fusion between the plates. This process is repeated at required intervals along the lap, thus giving a series of spot welds and having very much the same appearance as a countersunk riveted joint. Plates, angles and bars up to $\frac{3}{8}$ of an inch in thickness are very extensively welded by this process with a mechanical strength very much in excess of that obtained by riveting. Machines have been constructed for experimental purposes capable of welding three $1\frac{1}{2}$ -inch plates together.

The advantages of this type of welding over other methods of jointure are the absence of marking off or laying out, drilling or punching, countersinking, etc. Further, since these machines are almost entirely automatic and fool-proof, the saving in labor, time and improved output is considerable. A future use for fixed spot welders may be seen in the shipyard for attaching plates to angles and similar sections, assembly of coal chutes, ventilator ducts, deck houses, engine and boiler hatch plating, bulkhead stiffeners, etc. It is not expected that spot welders will be useful for the attachment and welding together of ship plating since such machines would have to be of the portable type similar to bull riveters, but much more cumbersome and heavy.

POWER COMPANY VIEWS USED IN PHOTOPLAYS

The "man in the street" will see the story of big hydroelectric construction along with the stories of romance and adventure, according to a recent report which states that the Southern Sierras Power Company has received a request for pictures and descriptions of all hydroelectric power houses on its system, together with those of any distinctive and picturesque features of the transmission and distribution lines. These photographs are to be filed at the New York office of the N. E. L. A. for use of the photoplay industry, which frequently applies there for such data. Demand for pictures and data also comes from writers who exploit basic industries in the popular magazines.



Is the door bell usually out of order?

MAKE IT AN ELECTRICAL CHRISTMAS
WITH A BELL RINGING TRANSFORMER

Electric Arc Welding

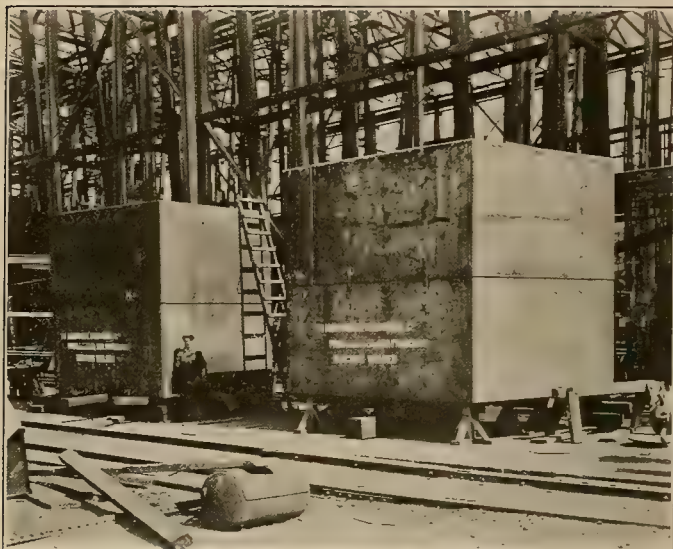
BY F. A. ANDERSON

(Increased efficiency in construction and repair work has been attained in many lines by the use of electric arc welding, and the following article takes up some recent industrial developments in which it has played an important part. The author is senior electrical engineer for the United States Shipping Board, Southern Pacific District, and has contributed several other articles on arc welding to the Journal of Electricity.—The Editor.)

Electric arc welding became particularly prominent during the war and was used to a great extent in the shipbuilding program, where its use increased production in a number of ways. It was not generally accepted for use on hull work or the floating equipment of vessels.

Arc Welded Pontoons for a Gold Dredge

The Marysville gold dredge Number 5 is used to reclaim the gold lost through the various processes previously employed for extracting this metal from the earth. Although this per cent of gold is



View of electrically welded pontoons which were made for the Marysville Dredging Company. These pontoons are 9 ft. by 14 ft. by 11 ft. 6 in. and in the final hydrostatic test did not show a single leak.

very small—said to be about 7c. per yard—these dredges extract it so successfully that they prove a wonderfully paying investment.

It was originally designed to dig to a 70-ft. depth below the water level. It was desired to increase this digging depth to 88 feet below water level and provide for handling a bank to a height of 20 feet above water level—a total range of 108 feet. This change necessitated the extension of the ladder and buckets, and also made necessary a greater buoyancy at the bow.

It will be noted that the bows of these dredges are cut in two, allowing for the operation of the ladder and buckets. To provide the necessary buoyancy it was decided to attach two pontoons to the bow of this dredge. These pontoons are built of steel, are 14 feet long, 9 feet wide and 11 feet 6 inches deep.

When the pontoons were first designed the usual riveted construction was contemplated, but after considering the saving in time and expense obtained by the use of the arc welding process, the latter was adopted as the most satisfactory method.

All the channels and beams were welded to the plates, employing what is known as the tack method. The tack method is to make short welds at predetermined or intermediate points.

After the pontoons were completed they were tested hydrostatically and not a single leak was found. There was absolutely no caulking necessary at any point.

Departure From Usual Practice

It is believed that these two pontoons are one of the largest recent developments where arc welding has been used throughout for any part of the floating equipment of a vessel. Here is a floating structure, subject to every strain of the main hull built along the same general lines, with beams, angles and seams held together without the use of a rivet in any part; not a seam to be caulked, not a doubling plate necessary, not a filler used.

Such a departure from the usually accepted practice should give confidence to those interested in similar work for the employment of arc welding in the cardinal parts of a vessel. Its economy cannot be questioned, for with arc welding properly used, the cost of drilling, reaming and caulking may be eliminated, leaving only the cost of the rivets, their heating and the riveting operation to be offset by the actual operation of arc welding, and in this comparison the advantage would be in favor of the arc welding process. These pontoons showed an actual saving of about 10% in total cost and about 5% in weight of material used.

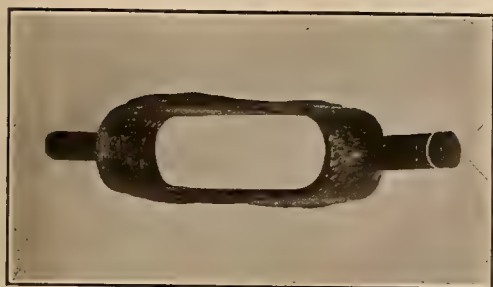
The pontoons were designed and built under the direction of Mr. George L. Hurst, mechanical engi-



Fig. 2. Cutter head on the suction dredge "Sacramento," showing the new knives welded on to the head.

neer and manager of the dredging department, Union Plant, Bethlehem Shipbuilding Corporation, Ltd., San Francisco, California.

Encouraged by his success with the pontoons, Mr. Hurst had the entire main deck of a gold dredge in Nevada electrically welded. This deck



Figs. 3 and 4. Showing construction of a frame for an ordinary sheave. The main body was cut from steel plate, and the two ends welded together as shown in the upper picture. The round pieces were then welded on either end as in the lower picture.

is 108 feet long by 52 feet wide; every longitudinal and transverse seam is being arc welded.

The plates are $\frac{1}{4}$ -inch thick and were placed allowing for $\frac{1}{4}$ -inch opening between all edges, providing the space for welding.

Transverse beams are on 30-inch centers and plates are secured to these beams by the usual rivets. There was some buckling of plates between beams which was corrected by drilling a $\frac{5}{8}$ -inch hole between plates and using a bolt with washers on either side of plate to pull the plates into proper position. The holes were finally filled by arc welding.

Welded Cutter Head

Figure 2 is a photograph of the cutter head on the suction dredge "Sacramento," in use by the Third San Francisco District Engineer's Office, United States Army, on dredging work in the upper waters of the Sacramento River. The picture plainly shows the new knives welded on to this cutter head.

These cutter heads are very expensive, and in the past have proven quite an item in the upkeep of the dredging work. They are of cast steel and on account of shape and size must be made in two parts. These parts are bolted together by means of webs or flanges to form the complete unit; this leaves a central section of blade with an open space and also allows the wearing away or "dragging" of the central flanges. As may be seen by the illustration the cutters arc welded on the old heads present a continuous cutting edge and prevent the objectionable "dragging" or wearing of the web.

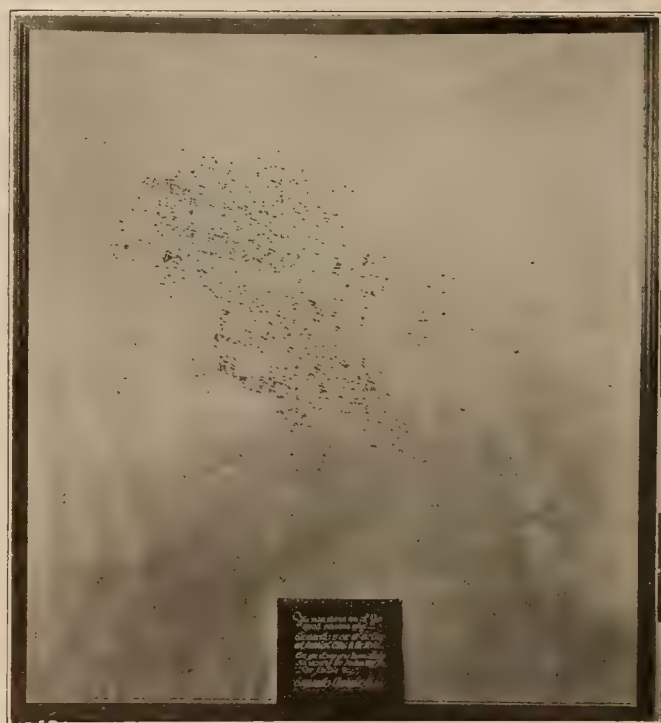
A unique method of employing arc welding in manufacturing is shown in Figures 3 and 4; these two figures show the construction of a frame for an

ordinary sheave. The main body was cut from steel plate and formed into shape, the two ends were then welded together as shown in Figure 3. The round pieces were then welded on either end, the weld making a fillet formation shown more clearly in Figure 4. The completion of the sheave follows as in the usual practice.

The Human Equation

An objection often advanced against the use of electric arc welding is the responsibility for its success, which is attributed to the operator, or welder. The fact is not disputed, that the operator must be a mechanic in the true sense of the word. He must be conscientious in his work, and he must be encouraged to attain success. It is not, however, believed that the human factor plays any greater part in the equation of arc welding than it does in any other mechanical trade. For the careless and incompetent workman in any mechanical trade can produce irrevocable loss and create faults which are far-reaching in their effects. The progressive engineer will select or train his men to be capable workmen.

REGISTERING SALES



Any company which sells a considerable amount of any one appliance will appreciate this method of graphically recording sales. The Sacramento Appliance Company displays a map of the city of Sacramento and vicinity, putting a pin of a certain color in the spot where a washing machine has been placed, a pin of a different color where a vacuum cleaner is placed, and so on until it appears that the entire region is a colorful array of electric appliances.



Does the gas heater explode every time you want a hot bath?

MAKE IT AN ELECTRICAL CHRISTMAS WITH AN ELECTRIC WATER HEATER

General Notes on Arc Welding

BY R. E. FRICKEY

(The choice of apparatus for welding, the training of welders, the testing of welds—these are important factors in successful welding, and are here discussed briefly by a consulting electrical welding engineer of San Francisco. Electric welding received a great impetus during wartime shipbuilding activity, and is now taking its place in industry as an important art requiring special skill and training.—The Editor.)

The increase in the application of arc welding during the war period was remarkable. The increase since that time has been steady, and it is probable that the growth of the art in the next decade will be tremendous. In an Eastern city, at a recent mass meeting called to organize a local section of the American Welding Society, there were present over one thousand men, most of whom were interested in arc welding. The peak in the progress curve will come when engineers, designers and manufacturers become personally familiar enough with the art to recognize its merits and limitations. With this familiarity and interest there must develop a sufficient number of proficient welders and men capable of supervising welding work.

Training Electric Welders

During the war period the Emergency Fleet Corporation operated schools for training electric welders. Since these were closed there have been in operation only two or three high grade schools where men are given a thorough training. There should be such a school in every industrial center. Most shipyards, railroads and large manufacturing plants using the process extensively, operate a training school for arc welders. Such schools are usually not elaborate. They are simply suitable places where one or two men at a time may be put through a series of systematic exercises under the supervision of a competent man. Such manual instruction is supplemented with lectures, or at least with informal talks during the working period.

An important feature of the training is the testing of all welds made, either in a pulling machine or by bending or breaking with a sledge. For some classes of repetition work a welder can be trained from suitable material in two or three weeks. For general work a longer period should be given. Great care should be given to the selection of the men to be trained. To make a good welder, a man should be conscientious above all else. Preferably, he should already be a mechanic or at least possess mechanical ability. Much of the good derived from a careful training will be lost if the man is afterward made solely responsible to a department foreman who is himself not a trained welder. It cannot be too strongly emphasized that welders require competent supervision. The welding engineer will require the same high grade training as that now received by the electrical, mechanical or chemical engineer.

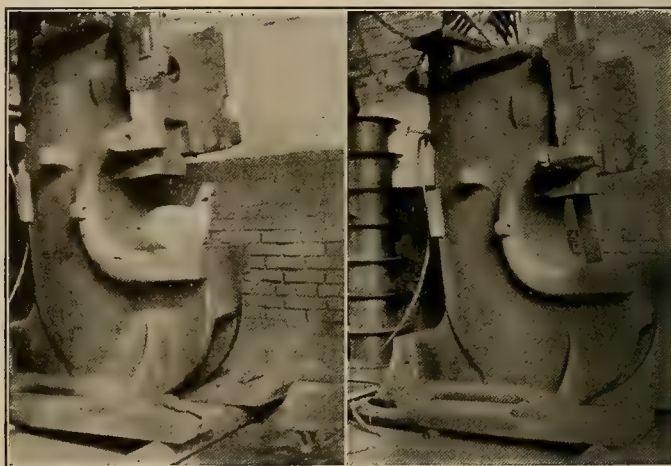
Much welding now being done is little more than plastering, and would be as effective if done with "smooth-on." It is true that much useful work need not approach 100 per cent efficiency, yet be good enough for the purpose intended, but the practice of permitting careless work under these conditions

makes it next to impossible to get careful work when such work is imperative.

Testing Welds

It is unfortunate that there has not yet been developed a satisfactory non-destructive method for testing welds. One method of promise which has been described is to cut out with a special tool devised for the purpose a circular disc, including about one inch of the weld to be tested. Two suitable plates are welded to this disc so that the weld may be pulled in a testing machine. The hole left by cutting out the sample is closed by welding in a properly prepared solid disc. This method is comparable to the testing of coupons from steel castings.

But welders can be trained so that they can make sound welds repeatedly, and this fact can be



The picture at the left shows a cast iron punch press prepared for welding; note the studding. The picture at the right shows the same press with a completed arc weld.

demonstrated by having them break or pull every weld which they make while in training. When the welder knows, and the man supervising his work knows, that he can make a sound weld every time, considerable confidence can be placed in the work such a man may do. Also, there are many factors which can be checked while the work is in progress. The proper preparation of the work to receive the weld is important. Cleanliness during the welding operation, size of electrode and current value, quality of electrode material, sequence of laying down metal, jigs for holding the work, backing for thin material—these are factors the supervisor can be sure about. Fortunately, too, there are certain "earmarks" about a good weld which can be recognized by a trained man. Among these are the depth of the arc crater, which is an indication of the "penetration" of the added material, and "overlap" of the metal being added, which is an index of proper fusion. In a weld

consisting of several layers, these indicators must be observed during the progress of the work, because only the top layer is visible.

Besides the matter of laying down metal in the proper manner and with the proper care, there is the matter of taking account of strains produced by the contraction of the added metal. Some of the problems arising in this connection are beyond the ability of the average welder and must be left to the supervisor with technical training.

Choice of Apparatus

While the proper selection of apparatus is important, it is not such a large factor in the production of sound welds as is commonly supposed. As good a weld as can be made with the most expensive welding machine can be made from a commercial 110-volt d.c. circuit with the aid of a rheostat constructed from a few cents' worth of fence wire and a bucket of water. Very good welds are being made with alternating current, using a transformer essentially as simple as an ordinary distribution transformer.

However, the choice of apparatus is important from the standpoint of convenience and economy. A modern one-man welding set will have an input of about 5 kw. when delivering 150 amp. welding current, while 16.5 kw. is required for the same welding current from a 110-volt d.c. circuit, not taking into account motor or generator losses. The 60-volt constant potential set is a compromise in point of economy between the one-man set and the 110-volt commercial circuit. It is entirely satisfactory as a welding supply, providing the wiring is so laid out that the voltage drop is not so great as to produce interference between welders. The constant potential system has the advantage over the one-man set that the regulating means may be beside the welders, rather than at some distant point.

There are several a.c. welding transformers on the market. These are considerably cheaper than the d.c. one-man sets, and are of about the same efficiency in energy consumption. The open circuit voltage required for a.c. welding is around 100 volts. The internal leakage reactance of the transformer is made high enough to deliver the desired current with the arc in series. Because of the high open circuit voltage required, the power factor is very low—for example, if 200 amperes at 20 volts, or 4 kw., is utilized at the arc, 200 amperes at 100 volts, plus internal losses, represents the kva. at the primary terminals. It is a curious fact that an external reactance used with a standard distribution transformer does not give the same characteristics for welding as does internal leakage reactance.

Alternating current welding has a legitimate field, although it is, undoubtedly, not as satisfactory for general work as is direct current. It is usually necessary to use some form of covered wire with a.c. Certain types of covered wire, such as those used exclusively in England, operate as well, if not better, on alternating current.

REFRACTORIES IN THE ELECTRIC FURNACE

BY CARL H. BOOTH

(An interesting point bearing on the durability of electric furnaces is brought out in the following extract from a paper delivered at the fall meeting of the Electric Furnace Association by the vice-president of the Booth Electric Furnace Co. The type of electric furnace best suited to industrial demands has been the subject of considerable experiment, and the question of durability and efficiency is of especial interest.—The Editor.)

It is well known that the life of refractories has had a great deal to do with the success or failure of electric melting furnaces. No stationary type of furnace has the same opportunity of securing the long life from refractories as that where the body of the furnace is in motion during some portion of the melting period. Obviously, the best results can be obtained from a furnace in which all parts of the lining are subjected evenly to the same temperature as far as possible, and this result can be further improved if the entire lining is washed by the hot liquid bath of metal, thus aiding in cooling the refractories and securing an even wear.

In the past year and a half adequate records have been secured from a rotating drum type, single phase arc furnace, used principally for the melting of non-ferrous metals, to show an exceptional life of refractories. The construction of this furnace being almost like a barrel, permits the removal of the two flat heads of the cylinder. The standard type of linings used have consisted of only three or four pieces, viz: a large cylindrical tile for the body of the shell and two circular flat end bricks for the ends. After these have been put in place, loose heat insulating material is tamped in hard between the brick and the steel shell and after the top end brick is in place, the steel end plate is bolted onto the shell. The bricks described have been made of a good grade of fire clay and due to the absence of joints and the rotation of the furnace, records have been made of 900 to 1000 heats from a lining. The pouring temperature in most cases will run in the neighborhood of 2100 to 2200° Fahrenheit, although many heats have been made on high temperature alloys where the temperature has averaged 3000° Fahrenheit.

The experience with this type of furnace bears out the statement that where the construction of the equipment permits the washing of the complete lining with the liquid bath the best possible life of refractories can be secured. It also demonstrates that it is entirely practical to use the ordinary class of material, which can be bought at the lowest price, and secure exceptionally long life refractories.



Does the Christmas tree remain dark after the first candles are burned out?

MAKE IT AN ELECTRICAL CHRISTMAS WITH A CHRISTMAS TREE OUTFIT

Public Utilities and the Railroad Commission

(The confidence of the public is essential to the successful and efficient service of the public utility. The following summary of a speech by the president of the California Railroad Commission points out the dangers of misrepresenting to the public the needs and plans which are vital to their well-being.—The Editor.)

Declaring that criticism of the California Railroad Commission is usually based on misstatements of a fact or a purpose, Edwin O. Edgerton, president of the Commission, in an address at a meeting of the League of California Municipalities held at Chico, November 10, told the representatives of the several score of California towns and cities present that they owed it to their constituents to inform themselves fully as to public utility matters before venturing to advise them. "It is important," said Mr. Edgerton, "that you do not by misstatement either purposely or ignorantly shake the confidence of the public in so important a matter as the regulation of public utilities."

Millions Must Be Spent

He emphasized the importance of the work of the Commission by declaring that hundreds of millions of dollars must be invested in this state by utility investors within the next few years, and that California progress will be seriously retarded unless the investor is given assurance that his investment will be dealt with fairly and intelligently. After a reference to the Commission's orders in rate proceedings, in which he said that the Commission did not base its findings on guesswork but upon exact information, the head of the California Commission said:

Instead of criticizing the Commission for thus promptly meeting emergencies, in my judgment it should be applauded. It has been demonstrated in California that public officials will carry out the mandates of the constitution and the law, and do the intelligent thing even at the expense of temporary unpopularity. . . . An answer to most of the objections that have been made to actions of the Commission would be an exposition of the facts.

It must be clearly understood that if California is to progress industrially there must be an immense increase in the facilities of the companies performing public utility service. Expressed in terms of money this will mean several hundred million dollars in the next few years. It must be admitted that there is no power to force investment in the securities of these companies, and sound policy becomes of vital importance in an assurance to the investor that his investment will be dealt with fairly and intelligently, else he will refuse to come in, and progress in the development of California will be seriously retarded. It may fairly be said that California today has a good reputation all over the country because of its attitude towards the public utilities. The impression is abroad that the California Commission will not confiscate money honestly invested, nor on the other hand will it permit extortion at the expense of consumers.

Reasonable Return Allowed

President Edgerton said the Commission was unwilling to assume that the people of California really desired that public utility rates be fixed so low as not to accord a reasonable return to investors—with the result that service will deteriorate and "all progressive increase of plant facilities cease." He said:

We of the Commission have long felt that this whole matter could be discussed on a basis of the consideration of what is in the interest of the whole state. With years of experience we have convincing proof that the companies

delivering to the people these vital public utility services must be kept sound, lest serious injury result in inefficient and bad service to consumers. Our people demand good service and will be satisfied with nothing less, and it is our conception that they are willing to pay for good service. Equally is it true that it is against the public interest to authorize or permit the exaction of unreasonably high rates for this service, but the placing of rates at an unreasonably low point will do as much injury to the consumers as placing the rates at an unduly high point.

I will make the assertion without qualification that, notwithstanding the substantial increase of rates generally accorded by our Commission to the public utilities, there has been no profiteering in this business in California. It is ridiculous to assert that where a profit of 6 or 7 or 8 per cent is accorded on investment this is profiteering.

Support of Public Opinion Necessary

President Edgerton also made the declaration that it is important that California have a sustained sound policy in dealing with the public utility companies, and that the Commission, as the medium for the official announcement of this policy, should have the support of public opinion. In this connection he said:

You who are the official representatives of municipalities have a very serious responsibility. It is your obligation, when you advise your constituents on public utility matters, that you not only state the facts as you are informed but that you fully inform yourselves before attempting to speak.

The Commission has the full responsibility of decision in utility matters, and having decided it later could not justify disastrous results by pointing to the request made by official representatives of cities.

Frequently it has occurred that we must deny requests based on limited information which requests, if granted, would have practically annihilated a public utility service and left the consumers in dire straits.

We do not guess at conditions and base our judgment on such guess, but rather do we carefully investigate time and again all of the conditions surrounding each of the utility companies and upon this exact information base our judgment. It is true that in the severe emergencies created by the war and conditions since, the Commission has acted promptly in according rate increases, but while we did not in such proceedings go into the affairs of the company with such particularity as under ordinary circumstances, we nevertheless knew that increased rates were vitally necessary to keep companies functioning and that the increase accorded would not result in unreasonably burdening consumers.

No Confiscation, No Extortion

Concluding his address, Mr. Edgerton said:

We might summarize our attitude towards investors in public utility enterprises in California by saying: We recognize your investment will result in common good. You are about to become a partner in an enterprise which will develop the community. We realize that the constitution of the United States and of California and the laws enacted thereunder are designed to protect your investment against confiscation. We are in full accord with the spirit of these laws and propose to proceed in accordance therewith. Furthermore, we believe it to be sound policy and in the interest of the public that your investment be protected and that you be accorded reasonable returns thereon, recognizing of course, that some risk attaches to all private enterprise. At the same time we inform you that you will not be permitted to make exorbitant profits nor will you be permitted to burden the consumers with poor service. Having said this to the investors we should carry out our pronouncements honestly and consistently, not only as a matter of honor but in the interest of the progress and development of the state.

A Sales Campaign on Electric Washing Machines

BY H. L. COOK

(Originality in advertising is one of the strongest factors in putting over a campaign successfully. Following is an account of a washing machine campaign carried out along distinctive lines by the Idaho Power Company. The author is salesmanager for the company.—The Editor.)

The first essential in any campaign is to find some method by which a definite prospect list can be secured, an object which was attained in the cast of a Thor Washing Machine campaign put over by the Idaho Power Company during last July, by a prize contest. The company offered a Thor electric washing machine to the customer writing the best article of seventy-five words or less as to why it

sold to the idea of the electric washing machine. In fact, if they were not sold, a great many of them evidently sold themselves by having written the article.

One of the main purposes of the contest, of course, was to obtain a list of prospects, and full instructions were sent to all branch offices as to how to handle the entries. On the closing date, all envelopes were removed from the machine and a list made of the contestants for the use of the sales force in that particular district. The letters were then sent to Boise where the contestants were again listed for a general file of prospects to be circularized from the main office.

An unexpected amount of sales information was obtained by reading through the letters. An article on the advertising of washing machines had come to the writer's attention some months prior to this campaign in which it was pointed out that it was absolutely wrong to use the word "drudgery" in advertising electric appliances, as it was stated, this tended to have a negative effect. This was absolutely disproven by the letters received during this contest. Over 90 per cent of the contestants used the word "drudgery" in their articles and it was difficult not to believe that the biggest appeal which can be made to women on household devices is through pointing



A delivery wagon loaded with washing machines was kept on the go in every important town of the power company's territory, whether there were any machines to deliver or not. This bore the sign "Everybody Is Buying Them" and proved to be a most effective continuous demonstration.

would be to the customer's advantage to have an electric washing machine. Advertisements were of course run in all the local papers announcing the contest and besides this, a circular letter was sent to each of the company's customers outlining the rules in detail.

There are several features of the rules which deserve mention. In the first place, contestants were not permitted to mail their answers to the company's office but were required to enclose their article in an envelope and to bring it in person to the power company's office, depositing it there in the cylinder of the Thor machine placed in the main building and in all branches for that purpose. This brought the contestants to a personal view of the machine and at the same time gave the salesmen an opportunity to point out some of the machine's good points.

It was also specifically stated in the rules that this was not a literary contest but would be judged from the thought rather than the manner in which it was presented.

Advertising and letters were gotten out ten days before the opening of the campaign, June 25 being fixed as the date of closing in order to leave time enough for judging the contest and making announcement of the winner. So many requests for an extension of time were sent in, however, at the last minute, that the contest was not actually closed until June 28.

Sales Information From the Letters

Nearly 2,000 answers were received in all—and by reading through a number of them, it was very plainly seen that the customers were more or less



The street cars, with conspicuous advertising signs at the rear, carried the message all day long to all parts of the city.

out the drudgery of their work without such conveniences.

Another interesting feature of the contest was the fact that about 80 per cent of those answering used verbatim the special points which the company



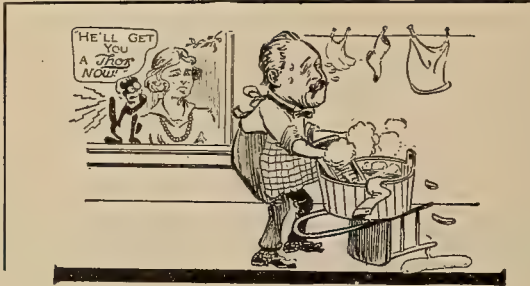
Does rich Aunt Sarah complain of the cold on every visit?

MAKE IT AN ELECTRICAL CHRISTMAS WITH AN ELECTRIC HEATER

had brought out in their washing machine advertising in months past. This indicated that the particular advertising in question had evidently made its impression at the time and that people had been reading it and making note of the various points as they were made.

Contest Results

The decision was in the hands of a committee of judges from the Boise Advertising Club, who announced their decision on July 7. Four answers



No Need to Wait Another Day

THOR

WASHING MACHINES

Price

Display advertisements were run three times a week in all the daily papers and in all weekly papers in the company's territory. Toward the end of the campaign a series of small ads recurring through the paper announced the end of the sale.

received special commendation and, believing that they could add something to the interest and the advertising value of the contest, the Idaho Power Company added three supplementary prizes to their offer. These were an electric sewing machine, a vacuum cleaner and an electric coffee urn, in the order named.

The prize essay was as follows:

WHY I WANT AN ELECTRIC WASHER

An electric washer is economy, health, wealth, wisdom and happiness personified.

1. Economy —
 - A. Saves time for other duties.
 - B. Saves laundry bills.
 - C. Saves clothes; threads remain unbroken.
2. Health —
 - A. Preserves youth and beauty.
 - B. Preserves energy.
 - C. Preserves cleanliness.
3. Wealth —
 - A. Helps us practice economy.
4. Wisdom —
 - A. Gives time for study.
5. Happiness —
 - A. Gives time for recreation.
 - B. Gives more time to family.
6. And last of all, there will be at least one smiling face on next washday in Payette, Idaho.

A letter was sent out to each contestant announcing the result of the contest and thanking them for their interest—and a few days later another giving the four prize articles. In both letters advertising was omitted, although it was intimated in the closing sentence that the company “hopes more than ever that sooner or later you may all be proud possessors of Thor Electric Washing Machines, which do so much toward lightening the hard work of wash day.”

The letters were now returned to the respective branch offices from which they originated so that they could see what particular argument would

FOR SALE—Wash Day Blues. Have been used once a week for years. Former owner has no further use for them, as she has just bought a Thor Electric Washing Machine from the Idaho Power company at their special price and special terms. Inquire of the Happiest Women in Your Town.

LOST
One full-size set of wash day worries. Finder may keep them. Former owner has no further use for them, since she bought a Thor Electric Washing Machine for \$10 down during the special July Offer. Inquire at the IDAHO POWER COMPANY.

SITUATION WANTED
WANTED—Washing to do. For two cents an hour I will do your family washing, everything from quilts to laces. No meals required and I am no trouble at all to you. I can have your washing out of the way by 9:30 every Monday morning. I am the Thor Electric Washing Machine. Take advantage of the special terms and the reduced price during July only.
IDAHO POWER COMPANY

FOR SALE—Improved health, increased happiness, more leisure, freedom from the drudgery of wash day. All these virtues combined in one package can be secured until Aug. 1 for \$10 down. Buy a Thor Electric Washing Machine during our special July offer and forget your wash day troubles.
IDAHO POWER COMPANY

Want ads cleverly worded to catch the eye and to appeal to the reader's sense of humor as well as his interest were used to supplement the regular advertising.

appeal to the contestant before going and talking to her. It was felt that this personal angle had much to do with the success of the sales work done.

Advertising the Campaign

Advertising for the campaign was begun on the 27th of the preceding month and every day thereafter including the first, an ad appeared calling attention to the special campaign ahead. On the first of

July, the advertising was placed on its regular basis of three times a week in all daily papers and in all weekly papers. Toward the end of the month the large single insertion was changed to a number of small cuts running throughout the paper calling attention to the advance in price at the end of the campaign.

A series of letters were sent out to all those whose names had been obtained through the contest and in addition a more personal letter was directed to all people reported by salesmen in their Daily Sales Reports as being interested in a washing machine.

Opportunity is Knocking
at Your Door
NOW

YOU CAN BUY A
THOR
ELECTRIC WASHING MACHINE
AT A REDUCED PRICE
JULY ONLY
\$10 DOWN

A Thor lasts a Lifetime

DON'T LET THIS OPPORTUNITY
SLIP AWAY FROM YOU

ELECTRIC SHOP
IDAHO POWER COMPANY
BOISE, IDAHO

Tags were hung on the doorknob of every residence consumer. These had all the advantage of handbills in the instantaneous attention they received without the annoyance usually attached to loose bits of paper which clutter up the sidewalk.

A bogie of three hundred machines had been set for the campaign—and was surpassed on the last day. The total for the month reached 304 washing machines, of which 282 were Thors and 22 Automatics of the other type carried by the company. The campaign was typical of all such sales in that a great many of the people waited until the last two days, 62 machines being sold on the last day of the month. In view of the extremely hot weather, as well as conditions of business depression, it was felt that all expectations had been fulfilled. It was also established that a campaign can make a good sales month out of a poor one.

A 110,000-Volt Wood Pole Transmission Line

BY L. J. MOORE

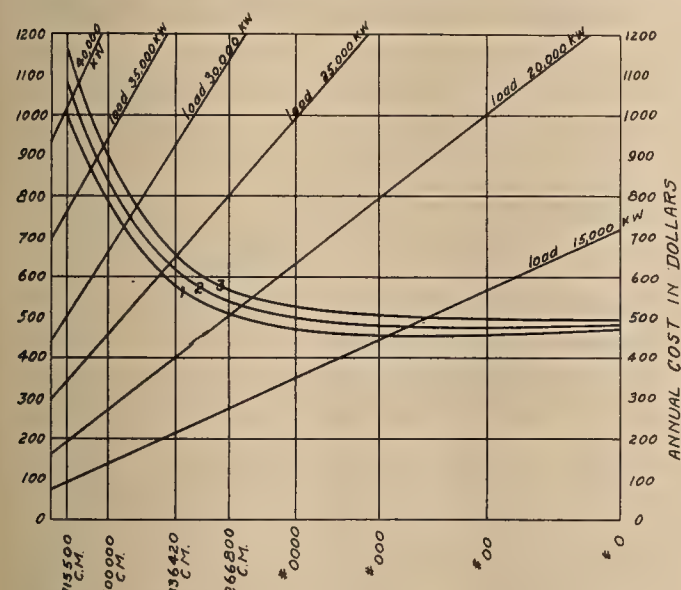
(Transmission line economies are of particular importance in the West where long-distance transmission at high voltage is the rule rather than the exception. The details of a wood pole line involving a number of economies are described here by the electrical engineer for the San Joaquin Light & Power Corporation.—The Editor.)

In designing the transmission line which was to carry the power from San Joaquin Light & Power Corporation's Kerckhoff Power House into the San Joaquin Valley, one of the most important considerations was that of right-of-way. The line must of necessity be constructed for the greater part of its length through the most highly cultivated part of the valley. Private rights-of-way would naturally

covering the San Joaquin Valley, and a line running practically due south from the Kerckhoff Power House would cut across this ring system, dividing it very closely in half and permitting step-downs to 66 kv. to be made at very advantageous points. A substation on the line east of Fresno and provided with the necessary outgoing 66-kv. line to Fresno and Reedley would effectively serve Fresno, the largest city in the valley, as well as the heavy irrigating load thereabouts. Another step-down at Corcoran would carry the Coalinga oil fields and the 66-kv. line to the coast over existing 66-kv. lines. Another step-down station at McKittrick would adequately care for the oil field loads in that district. Stations at these locations would allow the old ring system to be operated in sections so that in no case would the economical transmission distance for 66 kv. be exceeded and the new line would operate as a high tension bus for the system, provision being made for incoming lines from the company's Kings River plants to connect at the substation east of Fresno. To take care of the north district around Merced an extension of the high voltage bus is contemplated to extend west from the Kerckhoff Plant and reach as near the center of distribution as practicable, there being stepping down as in the other cases to 66 kv. and feeding into the old network of lines of that voltage. Power from the Bakersfield steam plant would enter the high tension line through the station at McKittrick, thus providing at least three points at which power would be fed into the line with more than that many points where power would be distributed from the line, and in no case would the actual straight away distance of transmission greatly exceed seventy miles, with the steam plant operating. The short distance of transmission thus obtained was another reason for adopting a voltage only moderately high.

Safety Factors in Construction

The altitude on the line is practically sea level; the highest point reached from the plant is about 1200 feet and that for a very short distance. Therefore the best conditions possible for corona were present. A study of all conditions showed that by using stranded aluminum conductors a cross section could be obtained which would be safe from corona and at the same time have the economical carrying capacity for the estimated load of the plant. This



NOTE: Loads taken at 100% load factor
Power Factor 85% lag
Cost of Power Loss \$.00525 Per KWH

CURVES
#1 Al at 25¢
#2 Al at 30¢
#3 Al at 35¢

ANNUAL CHARGES:
9% Interest 2% Maintenance
4% Depreciation 15% Total

Curve sheet showing annual cost per mile of 110-kv. line, 3-phase, 60-cycle, aluminum conductor, San Joaquin Light & Power Corporation.

have cost a large sum of money, both on account of the high value of the land and on account of the large acreage being owned by foreign born citizens, many of whom practically refused any concession. The only alternative left was to build along public highways, which meant structures with very narrow bases, or in other words, steel or wood poles.

The construction of a high tension power line on poles, immediately raised the problem of clearances between conductors. Ten feet clearance was considered quite feasible, but any more than that was considered rather dangerous on account of the fact that it would make the poles top heavy and would further hang the conductors too great a distance into the private property along the highway. The matter of clearance in such construction worked out toward a medium high voltage line.

Adapting Line to Existing Facilities

The location of substations and sources of power along the line also worked out for the more moderate voltage. The company had already in operation a large ring system of 66,000-volt lines, approximately



Does the cook leave because the house has no electric conveniences?

MAKE IT AN ELECTRICAL CHRISTMAS WITH A VACUUM CLEANER

was obtained by figuring the plant at 30,000 kw. maximum with a load factor of 70 per cent, using a line 135 miles long with a voltage of 110,000. From the discussion already given of the location of incoming feeds and distribution points, it is evident that much more than 30,000 kw. can be handled over the line without exceeding the economical current density.

110,000 volts was chosen as the transmission voltage to be used. A line was designed using 266,000 c.m. all aluminum conductors on sixty-foot steel poles, spaced 587 feet apart, or nine to the mile. A loading of 8.75 pounds of wind per square foot without any ice or snow was used in the calculations. The question then arose of using wood poles of the same length instead of steel, leaving spans the same. With the same conductor and wind pressure it was found that a sixty-foot pole with a 9-inch top and 15-inch diameter at the ground line had a factor of safety of 3.10 against horizontal loads and of 10 as a column. When the fact is considered that the Weather Bureau records of Fresno, for a period of over thirty years, show a maximum of 4.5 pounds per square foot of wind pressure, the factor of safety is then seen to be more nearly 6, which provides ample safety. As a matter of fact, the poles as installed ran near to 20 inches in diameter at the ground, so a line is safe enough from overturning if the setting is secure.

Expressing the factors of safety as the ratio of the ultimate working strength to the stress which would be applied under the maximum loading conditions, the safety factors found in the design are as follows:

Conductors	2
Pole line hardware.....	4
Insulators on dead ends.....	3
Insulators in suspension.....	12
Guy insulators (interlocking).....	2
Guys	2
Wood poles as a column.....	10
Wood poles transverse loading, railroad crossing	5
Wood poles transverse loading, highways.....	3.4
Steel cross arms: vertical loads.....	7
dead ends	3.6
Foundation against depression	3

The line falls entirely within light loading territory and the above factors are materially greater than those set up in the proposed rules. Furthermore, the figures are based upon the assumption that the poles have a diameter of 15 inches at the ground line while the general average, as stated above, is more nearly 20 inches. The safety factor of 5 for railroad crossings is obtained by shortening the span at such crossings to 200 feet. All poles in straight-away work were set 8 feet in the ground and all dead ends and corners were set 9 feet in the ground. As a check on the depth of setting, all poles were stamped with the company's initials at a distance of ten feet from the bottom. The distance of this out of the ground is a direct indication of the depth of setting.

Economy in Use of Wood Poles

As to the economy of wood poles as compared to the steel poles, the following figures are given:

The lowest priced satisfactory steel pole, set in place, would have cost, using July, 1920, prices, \$148.60. This includes a concrete base. A creosoted wood pole installed would cost \$69.50, showing a

saving of \$79.10 per pole. This saving at seven per cent interest compounded annually, would amount to \$306.12 at the end of twenty years. From the past experience of this company and the opinions expressed by others, creosoted wood poles show an average life of about twenty years. The interest alone on the money saved in this particular instance would amount to \$227.02 in twenty years. This is 3.26 times the original cost of the wood pole installed, and it is thus seen that even if poles practically doubled in cost in that time, it would still be possible to replace them with the interest on the money saved. At the time of construction, the difference between wood and steel was even greater than that here indicated because wood poles at that time cost about 50 per cent of what they do today. The increase in the cost of steel, however, has not been so great.

Wood poles show greater mechanical strength when they are new than the steel pole which was considered. This is proper in that the rate of deterioration of wood is much greater than that of steel. However, it shows an angle in the matter of choosing between the two materials which must not be overlooked. If the steel pole is to compete with the wood pole in price, it must be designed with as small factors of safety as are at all safe for the individual installation in mind. Wood poles as a rule have larger factors of safety than necessary, especially where the conductors used are medium or small in size. It is often possible then to increase the size of conductor on an existing wood pole line without any danger whatever, whereas the same procedure on a steel pole line might not be allowable on account of exceeding the mechanical strength of the supporting members. In distribution work it is often necessary to hang a bank of transformers on a pole already installed in the line. If the pole is of wood, the chances are that the procedure is entirely safe, but if it is a steel pole the loading must be carefully calculated and the strength of the pole compared with the result to see whether or not it is necessary to install a heavier pole.

Interruption of Line Service

From a standpoint of service, it is no doubt true that a steel pole is the better. Its life is of course longer than that of a wood pole, and if this is twice as long, it naturally holds that the interruptions to service for the changing of supports would be not over one-half the number in case of steel as of wood. However, in the particular instance herein described, it is felt that the line as constructed is not large enough to handle the ultimate power transmission of the company and that at least a second one of the same capacity paralleling the first in route as nearly as possible, must be constructed sooner or later. It is hoped to carry this line through the same substations as the first and to install balanced relay protection between the two in all sections. This will practically eliminate the interruptions from ordinary cases of trouble, and the fact that the line is constructed in duplicate will make it possible to change poles when necessary without interruption to service.

(Continued on page 546)

Trunk Transmission Lines

BY C. EDWARD MAGNUSSON

(Shall the transmission line serving the future super-power zones of the West be reckoned as a common carrier? Such a ruling has already been made in connection with a recent suit decided in France. The suggestions here made by the professor of electrical engineering at the University of Washington carry the interest of a new idea into the problem of interconnection which is undoubtedly to be the trend of Western power development.—The Editor.)

Much valuable experience has lately been gained in the operation of extensive high tension systems. Due in part to new construction, but in most cases to electrical interconnection of two or more previously independent companies, the mileages of several transmission systems operating in synchronism have been greatly increased. In the past, independent long lines, connecting a hydroelectric power plant to some city or industrial load, formed the mile posts of progress. Thus the construction of the Big Creek line transmitting electric energy to Los Angeles, a distance of 242 miles, made both new high voltage and long distance records and was replete with new features of design. Lately the advance has been chiefly in the large mileage of high tension lines operating in synchronism, connected in a network spread over a great area or a chain of lines having a number of power plants and widely separated loads. For example: The Montana Power Company, in connection with the Chicago, Milwaukee & St. Paul Railroad, operates over a thousand miles of 100,000-volt transmission lines. In California, war time conditions forced several of the companies to interconnect and operate in synchronism. The recently completed 110,000-volt transmission line constructed by the Inter-Mountain Power Company in connection with the electrification of the Othello-Tacoma division of the C. M. & St. P. RR., formed a connecting link between the Washington Water Power Company in eastern Washington and the Puget Sound Traction Power & Light Company on Puget Sound. In August, 1919, when the interconnection was completed, the transmission lines of these companies and of the Pacific Power & Light Company were merged into a single synchronously operated system having approximately 1500 miles of transmission lines.

Advantage of Interconnected Systems

As an illustration of one of the advantages gained by interconnecting systems, it may be mentioned that in the fall of 1919, during the low water period on Puget Sound, approximately 10,000 kw. were taken from the surplus water power of the Spokane River and transmitted 262 miles to supply the deficiency in Seattle.

The experience gained in operating these extensive combined systems in synchronism is of great value. The evidence obtained is fairly conclusive that the operation of huge transmission systems presents no insurmountable difficulties; in fact, the increased mileage seems to be more of an asset than a liability for securing satisfactory operation.

That transmission systems having an even larger mileage of high tension lines operating in synchronism will be in general use in the future is

certain. With the completion of the electrification of the western division of the C. M. & St. P. RR.—that is, by closing the gap between Othello, Washington, and Avery, Idaho—all the transmission lines from eastern Montana to Puget Sound will probably be operated in synchronism, as one electric unit. Similar extensions may also be made north and south along the Pacific Coast. By the construction of a few comparatively short sections of high tension lines all the larger power companies operating in British Columbia, Washington, Oregon, California, Idaho, Utah and Montana, at present totaling over 12,000 miles of transmission lines and over 2,000,000 hp. generator capacity, could be electrically united for synchronous operation as one system.

New Era in Power Transmission

However, the mere tying together of two or more systems that were designed and constructed to operate as independent units, can bring only a small part of the advantages that would be gained if the final scope of the system had formed the basis of the original design. The present interconnecting practice is mere patchwork, a temporary makeshift by which comparatively small advantage may be gained. Interconnection of transmission systems is chiefly important as a mile post of progress in that it shows we are on the eve of a new era in power transmission.

While the social and industrial unrest which naturally followed in the wake of the World War has temporarily delayed progress, it seems certain that in the near future the United States will enter on an unprecedented industrial development and intense industrial activity, which predicates a great increase in the electric power supply. Under the spur of international competition the production of each industrial workman must increase if American standards of living are to be maintained. The demand for power will be greater than the increase in the number of workers; for the assumptions seem to be justified that the output per worker is approximately in direct proportion to the power used, and that an increase in the use of power benefits both the workers and the employer.

With a rapid increase in the demand for power it becomes increasingly important that national economy be exercised in the conservation of the available power resources. By an extended use of



Is the only place for an easy chair in the dark corner of the room?

MAKE IT AN ELECTRICAL CHRISTMAS WITH A PORTABLE LAMP

electric power transmission very great economies could be effected.

(a) By the early development of all available water power. Every kilowatt developed is a kilowatt saved. More than 40,000,000 kw. are at present going to waste on our undeveloped water power sites.

(b) By the construction of very large central station steam plants as near as possible to the coal supply. With large units of high thermal efficiency very great economies could be effected. The transportation of the electric energy over trunk transmission lines would be more economical than the shipping of the raw material, coal, by rail. Such a system for the Atlantic seaboard was proposed in a paper read at the Boston meeting of the A. I. E. E. in March, 1919; and recently Congress appropriated the sum of \$125,000 for a super-power survey of the Atlantic seaboard region.

(c) By the electrification of the railroads. There is no longer any question but that the electrification of trunk railroad lines is economically desirable. It has been estimated that an annual saving of 100,000,000 tons of high grade coal would be effected by this change.

(d) By a more general use of electrically driven machinery in the industries.

suggested system of trunk transmission lines for the three Pacific Coast states. Geographically, California forms a single natural power unit and the trunk transmission line should be located, as indicated on the map, in the Sacramento and San Joaquin valleys, extending practically the whole length of the state.

In Oregon the trunk line would be along the Willamette, Columbia and DesChutes rivers. For Washington the trunk system would be somewhat more complex as indicated on the map. In Fig. III more details are shown for the Puget Sound industrial region in western Washington.

The main trunk transmission line is drawn as a full line while the broken lines indicate laterals leading to the more important power sites. The figures indicate horsepower. The circles mark the location of power plants in operation, and the squares the undeveloped sites with figures showing the power

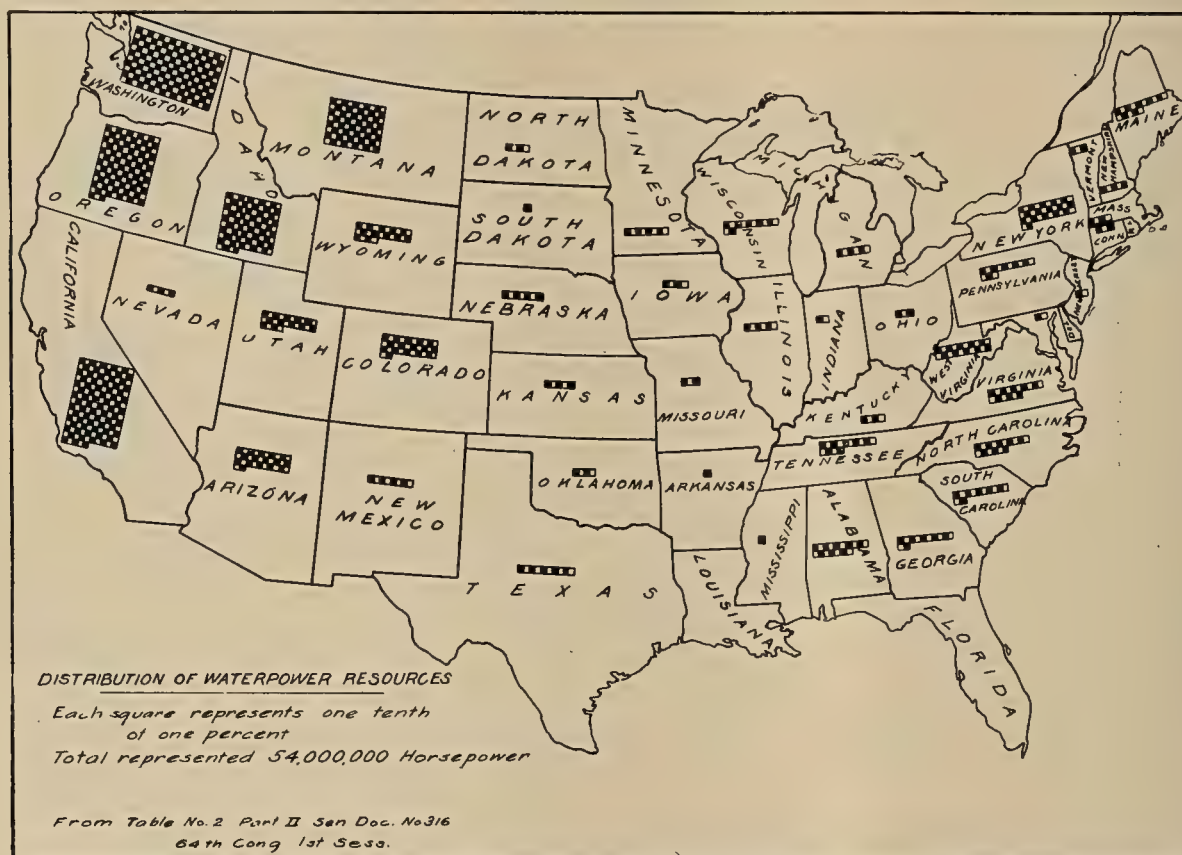


Fig. I.—The above map shows the distribution of water power resources of the United States amounting to 54,000,000 hp. The efficient and economical distribution of the electric energy derived from their development is one of the most important of national problems.

Future Power Developments

Even a casual consideration makes it evident that power developments in the future must be on a much larger and more comprehensive scale than in the past. Instead of a single power plant connected to a definite load at some far-away center by an independent transmission line, the natural geographic divisions must be taken as the basic units. This predicates the construction of trunk transmission lines to which all the power plants in a given region would deliver electric energy and from which all retail distribution systems would receive power. In Fig. II is shown the approximate location of a

now being wasted. The estimates are conservative and include only undeveloped sites where at least 10,000 hp. could be developed. By including smaller sites and developing storage facilities, the estimate of the available power for this region should be more than double that given in Fig. III.

Suggested Methods of Procedure

In order to plan wisely for the development of water power in any region, it is important to first determine the main outlines of a basic system suitable for the utilization of all the available power, although construction necessarily would consist of a

series of comparatively small unit additions extending over a long period of years.

From the engineering point of view, the design, construction and operation of extensive trunk lines or super-power systems offer no serious difficulties. All the engineering features of the proposed trunk line systems are well within the present state of the art; operating conditions can be predetermined and satisfactory results guaranteed. The insulation is generally considered as the weakest element in high

trial activity; manufacturing, transportation, and retailing of electric energy are covered by the same company.

Electric energy is a manufactured commodity. Generating stations are the factories; the product, being "perishable goods," is transported to market as soon as manufactured, over long distance transmission lines, and immediately delivered in retail to the individual customers over the low voltage distribution network.

Electric transmission lines are analogous to railroads in that "the service rendered is strictly distributive and of a public service order," although electric systems transport only a single commodity, electric energy. With extensive transmission systems covering several states, the transportation of electric energy may well come under laws of essentially the same characteristics as obtain for the railroads. Several years ago it was found necessary to limit the activities of the railroads to the transportation field. With power developments on a comprehensive scale, based on natural geographic divisions, it may likewise be advisable to make the transportation of electric energy an independent business, separate and distinct from the generation and distribution divisions.

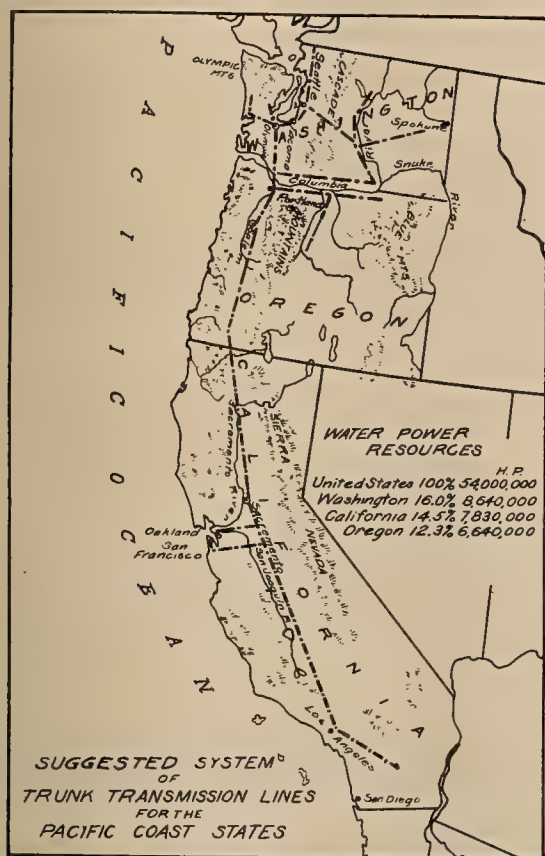


Fig. II.—Approximate location of a suggested system of trunk transmission lines for Washington, Oregon and California.

tension transmission line designs, but recent investigations give conclusive evidence that insulators now in the market give adequate insulation up to 250 kv., which is greater than is required in the economical design of extensive trunk line systems.

However, the technical work of the engineer concerns only a comparatively small part of the whole industry. Administrative and legal problems of prime importance must be solved before any marked progress can be made towards the realization of super-power systems. Fundamental questions of ownership and control, regulation and management, and in fact most of the complex administrative problems of public utilities, will require new interpretations and solutions consistent with the imposed conditions.

In the creation of a super-system for any extensive region, as the Atlantic Seaboard or the Pacific Coast, it may be found advisable to form a new cleavage on the basis of the kind of service rendered, to limit the activity of each organization to a single business. Under present conditions, most electric power companies have a "Three in One" form of business organization—three distinct fields of indus-

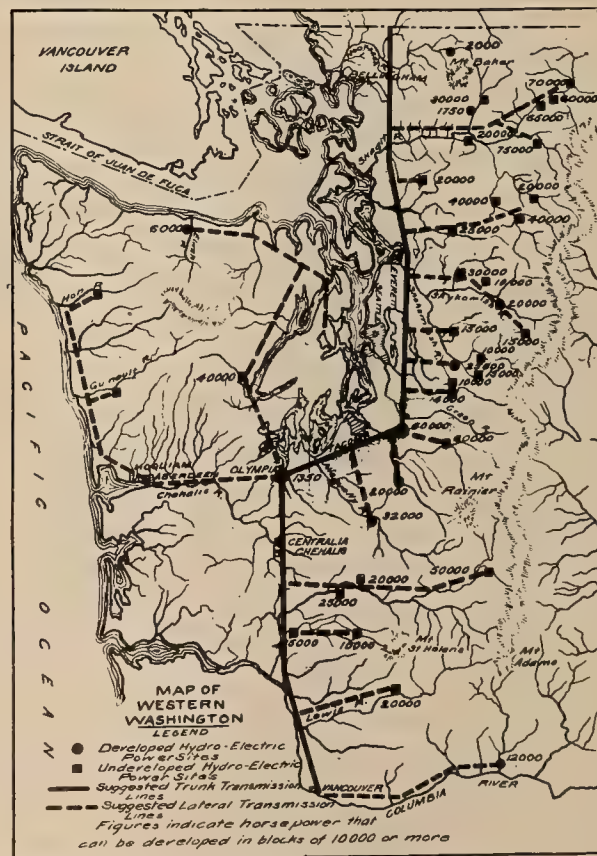


Fig. III.—Map of the suggested transmission systems of the Puget Sound industrial region of western Washington shown in greater detail.



Does the laundry bring things home to you
you never saw before?

MAKE IT AN ELECTRICAL CHRISTMAS
WITH A WASHING MACHINE

Electricity for Brass Making in the Northwest

BY W. C. HESTON

(The high cost of metals and the shortage of fuel have been important factors in the rise of the electric furnace. Some of the specific advantages of the electric brass furnace are here presented by the industrial engineer for the Portland Railway Light and Power Company.—The Editor.)



Pouring a 3500-pound charge of manganese bronze for casting propeller blades.

THE electric brass furnace made its debut on the Pacific Coast early in 1920, when the Oregon Brass Works installed two electric brass furnaces, one of 1000 pounds capacity and the other of 2000 pounds capacity, in its foundry at Portland, Oregon. Although it has long been known that it was theoretically possible to eliminate a large part of the metal loss inherent to fuel fired furnaces, by the use of the electric furnace, it has only been within the last three or four years that the elec-

tric brass furnace has been developed on a commercial basis. The war, with the incident high cost and poor quality of crucibles, the high cost and shortage of important metals, and the demand for production at any cost, were factors which gave impetus to the electric furnace for melting non-ferrous metals.

The continued high price of all kinds of fuels has tended to accentuate the collateral advantages of the electric furnace and has placed it on a firm post-war basis.

The one great advantage of the electric furnace is the reduction of metal loss to an absolute minimum, the loss being 2 per cent or less as compared with 8 or 10 per cent in fuel fired furnaces.

Figures compiled by Dr. W. H. Gillett of the United States Bureau of Mines for the year 1914, show that in 3600 plants throughout this country, \$200,000,000 worth of brass was melted with the value of metal lost beyond recovery not less than \$6,000,000.

The furnaces at the country of the Oregon Brass Works are of the single-phase, indirect arc, rocking type, made by the Detroit Electric Furnace Company. The rocking of the furnaces causes the molten metal to wash four-fifths of the lining of the furnace twice each minute, thus giving a high thermal efficiency and a thoroughly mixed and homogeneous product.

Current is supplied to the 1000-pound furnace by a 150-kva. transformer, and to the 2000-pound furnace by a 300-kva. transformer. Both are single-phase transformers rated, 11,000/115 volts. These transformers have an inherent reactance of 8 per cent and an external reactance of 20 per cent, with

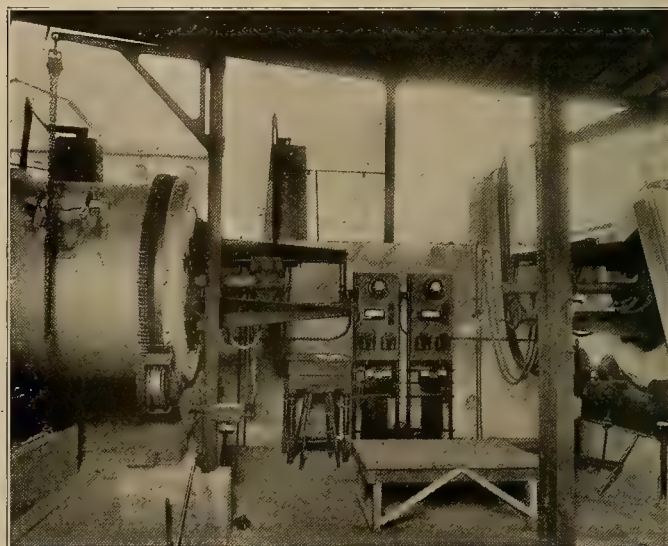
several taps by which the voltage across the arc may be varied. Current is conducted to the furnaces by copper busses extending through the top of the transformer vault and thence by flexible cables to the 4-in. graphite electrodes which are hand controlled.

Each furnace has a switchboard panel which has mounted on it in addition to the contactors for controlling the rocking motors, relays, oil switch controls, etc., an indicating wattmeter and a watthour meter, which is set back to zero each time a heat is started as the kilowatt-hour input into a charge is a direct measure of the temperature of the charge, and consequently indicates when the metal is ready to pour.

The results of the first two months operation showed the following costs per hundredweight:

Power	\$0.259
Electrodes	0.031
Lining	0.040
	<hr/> \$0.330

The power consumption was 13.1 kw. per cwt., and the metal loss on some special runs where the weights were carefully checked, ranged from 2.34%



Electric Brass Furnaces at the foundry of the Oregon Brass Works, Portland, Oregon. The furnace shown on the left is 1000 pounds capacity and the one on the right 2000 pounds capacity. In the center of the picture may be seen the switchboards mounted near the substation wall, for controlling the current supplied to the furnaces.

on 15 heats of red brass borings to 2.81% on 8 sheets of manganese bronze, containing 41% zinc.

Mr. W. F. Prier, president of the Oregon Brass Works, has always been a pioneer in his field, and the installation of the first electric brass furnaces west of the Mississippi river is only another indication of the progressive spirit of his firm.

The Fuel Oil Situation on the Pacific Coast

BY D. M. FOLSOM

(The fuel oil situation is one which has been engrossing the attention of engineers and leaders of industry for some time. The following paper takes up the question as it affects industrial progress on the Pacific Coast, pointing out that hydroelectric development is one of the most important solutions of the problem. The author is director of the Land Department of the General Petroleum Corporation.—The Editor.)

The fuel oil situation on the Pacific Coast can be viewed from three angles: from the viewpoint of the men within the oil industry itself; from the standpoint of the direct consumer, who in a sense corresponds to the middleman of other industries; or from the position of the great group of indirect consumers who make up the entire Pacific Coast community.

The first two groups have from their viewpoint a relatively short perspective. The question of immediate supply and demand, the success or failure of developments in new fields, the decline in field storage, and the price, seem of prime importance.

The third group is separated by a greater distance from the actual operations of the industry. From this longer perspective the questions of conservation and of future supply appear as the real problem.

The monthly reports of the State Mining Bureau show clearly that there is more drilling in the state today than ever before; and detailed study of the new locations show that every possible effort is being made, both to maintain production and to find new fields.

The immediate situation will always be critical, both for the producer and for the consumer. To them, oil is a commodity which is bought and sold on a daily market; and the pendulum of the market may swing rapidly from one side to the other.

The indirect consumer recognizes oil only in the form of transportation service, or in the form of a product manufactured through the use of oil. The situation does not change from day to day and from week to week. From his standpoint it follows a steady course, becoming constantly more critical.

Growing Consumption of Fuel Oil

The real interest of the community is, therefore, in a future supply of energy for the maintenance and expansion of Pacific Coast industries and transportation facilities. At present, the Coast is dependent upon oil for over 70% of the consumed heat and light and power; and oil production is not equal to the resulting demand. We have forced oil to carry more than its share of the burden of supplying energy, and the oil supply is no longer sufficient to carry this load.

That is the gist of the present situation. Consumption is overrunning production, and there is no prospect of new production sufficient to meet the growing demand. Furthermore, the increase in refinery output, to furnish an ample supply of gasoline, has reduced the proportion and quantity of fuel oil available from the crude output of the wells.

Take the present annual output of oil—100,000,000 barrels—as representing 100 units of energy.

Then we have in the past twenty years consumed 1,200 units, and have as a reserve ahead of us underground 2,400 units; that is, a third of our visible supply of oil is exhausted. New fields may add somewhat to these estimated reserves, but the facts will still remain, that our supply has a limited life, and that the present rate of production cannot be long continued.

Now, as to the utilization of our 100 units of energy available from annual production; the oil industry within itself uses 8 units, and the products of our refineries,—gasolines, distillates, and lubricants—account for 17 more. This last represents the energy now consumed in automobiles, tractors, trucks, motor boats, and other internal combustion engines, which require high grade fuel.

Our fuel oil consumption each year equals 85 units and we have had to draw on stocks to make up a deficit of 10 units per year. In addition, we are facing from every side a rapidly increasing call for more energy. Not only do our present industries require additional oil, but new industries and new shipping are making insistent demands for fuel. Incidentally, the amount of fuel oil in storage now is not over 10,000,000 barrels—equal to the amount of our annual shortage, that is, 10 units of energy.

The Demands of Modern Industry

This is no artificial shortage which confronts the community. It is actual and immediate. Think what this means in terms of the future! Here in California we have had deposited to our credit a great reserve, invaluable as a natural resource, and unreplaceable when it is once withdrawn from the ground.

We have been living in a complicated industrial age, dependent upon transportation and manufacturing for our food and our clothing—and we have been forced to draw heavily on our reserves to meet our current needs. Instead of planning as a community to make the most of our resources, and to provide against their ultimate depletion, we have gone calmly ahead drawing on the bank without any idea as to where we shall turn when our drafts are no longer honored.

Obviously, this condition must end. We cannot continue to burn more oil than we produce, and we cannot continue indefinitely to count on even our present production. There can be only one answer to



Does your husband look like an accident victim after shaving?

MAKE IT AN ELECTRICAL CHRISTMAS WITH AN EXTRA BATHROOM LIGHT

the situation—some one who is burning oil today will have to use another source of energy tomorrow.

The real difficulty comes up when we try to decide which industries or what localities shall first give up oil. To attempt a priority list to give advantage to more essential use does not solve the question, as all consumption seems essential. For example: the 85 units of energy consumed each year are divided about as follows:

Railroads	34	units
Shipping, including Navy.....	16	"
Other Public Utilities.....	12	"
Metal, Lumber, Cement, & Chemical industries	12	"
Food industries	8	"
Heating	3	"

Roughly speaking, two-thirds of our fuel oil is used to provide energy for transportation, and upon this transportation we are dependent for our commercial existence. The Navy has demonstrated its absolute need for oil; the Shipping Board has publicly announced that it must have liquid fuel if it is to attempt competition with foreign boats; and the railroads, except to a limited extent in the Northwest, are absolutely dependent upon oil if they are to use fuel of any sort.

The public utilities use oil for the manufacture of artificial gas, and for the operation of auxiliary steam plants for the generation of electric power. During the past two years the power companies have been forced to carry a large part of their total load on oil, and even with increased hydro-electric development now under construction large quantities of oil will be required for stand-by service. There is no apparent chance to end the use of oil by public utilities.

The industries which are now developed in California, Oregon and Washington, cannot safely be penalized by forcing them to more expensive fuel, especially when these industries are not adequate to make the Coast self-contained and commercially independent. To wipe out our manufacturing would only add to the transportation burden, and increase the use of oil in another direction.

There is no solution through the priority restriction, except in outlying districts where coal in some form is available, and to a great extent this geographical curtailment is already in effect. The copper mines in Arizona, Nevada, and Utah, and many of the varied industries in Washington and Oregon, have already been forced back to coal; but offsetting this deliberate restriction of outside consumption the natural increase in demand here at home has absorbed this saving and has kept total consumption above the rate of production.

Hydro-electric Energy as the Solution

To my mind, there are only two possible solutions to the energy problem of the Pacific Coast: first, through the development of our water power reserves, and the substitution of hydro-electric energy for the burning of oil wherever possible; and, second, through the installation of internal combustion engines in the place of boilers and steam engines.

These steps must be taken sooner or later, and further industrial development on this coast must wait on their completion. It is obvious that we cannot increase our production of raw materials, nor operate new factories, nor increase our shipping, unless we have increased motive power.

The program for increasing hydro-electric development is not simple to carry out. It requires both time and money. But, difficult as the program may be, it must be undertaken and completed, unless we, as a community, are willing to see our industries and our commerce decline for lack of power. Regardless of the cost in money, regardless of the labor involved, and of the machinery and of the quantity of copper required, the potential power of the Pacific must be made available, and distributed to industries over a completely interconnected system of transmission lines.

It is not necessary here to consider the details of the substitution of one form of energy for another. In the end, hydro-electric power must replace oil on land, wherever it is possible to make the substitution. We cannot yet transmit electric current on sea, nor provide electric motive power for boats through storage, and oil must continue to be the natural source of energy for our shipping. In our boats, however, and on land wherever oil must be used, we must develop and install internal combustion engines in order to get efficiency in the use of our fuel.

Community Cooperation Necessary

There is nothing new in the program which I have outlined. It has long been recognized by engineers that it was an economic crime to burn up our limited supply of fuel, and at the same time neglect to develop the inexhaustible power contained in our mountain streams; and it has been common knowledge that engines of the Diesel type would virtually increase our fuel supply by making one barrel of oil do the work of three.

The present policy of the Federal Government makes it possible for public utility companies to get permits for power development, and it is strictly up to the community to get behind such development in every possible way. The successful completion of a program of development and substitution of electric power requires more than engineering skill. It requires constructive work on the part of every organization interested in the welfare of the Coast.

The greatest difficulty in the way of the power companies in undertaking this development is the matter of finance. We have been too anxious in the past to get our energy cheaply. We have virtually demanded of our public utility commissions that the rates be regulated and kept at a minimum. Now, if we want power for the future someone will have to pay for it. If we do not pay today, we will have to pay fourfold tomorrow, not only in actual money, but in loss of production and loss in trade consequent upon an actual power famine.

We must realize that the success of this program is vital to our prosperity, and that success can come only through the substantial encouragement of community support.

An Emergency Steam Plant for Rice Irrigation

BY RUDOLPH VAN NORDEN

(Foretelling a power shortage, where an insufficient supply of pumping power meant ruined crops, saved a large area planted to rice. The situation calling for this emergency plant was described in the previous issue, and the details of construction are given here in the concluding half of the article. The author is a well known consulting engineer in San Francisco.—The Editor.)

The steam plant contract called for an installation to accompany a 1,000-kw. a.c. turbo-generator, but with an additional payment specified should machinery be found to increase the capacity to



A view from the canal bank, taken about June 10. On the left is the main canal; on the right, the oil storage tank. The turbine is on the elevated structure with condenser and auxiliaries to the left. The heavy tackle behind the third boiler in the right background is in the act of raising breeching in place.

1,500 kw. An opportunity was presented for the purchase of a 1,000-kw. generating unit, then on the testing block at the Ridgway Dynamo & Engine Works, Ridgway, Pa., and this machine was contracted for. Within a few days, notification was received from the Ridgway representative that a 1,500-kw. unit which had been ordered was unexpectedly available owing to a change in the purchaser's plans, and quick action by telegraph secured this unit in place of the smaller one. Then the United States Shipping Board was appealed to for boilers, as it was known that great quantities of new marine equipment was available at many Government yards throughout the country. The necessary boilers were found in Oakland, where one of the 9,600-ton ships under construction was to be rearranged for a change from a cargo carrier to a refrigerator, after the boilers intended for the ship had already been delivered to the yard of the Moore Shipbuilding Company. These boilers were available and three of them were immediately purchased, as they fulfilled the requirements very nicely. The necessary boiler-feed pumps and a dry-vacuum pump were also purchased from the Shipping Board, also most of the necessary 4-0 copper conductor for the transmission line.

The principal pieces of apparatus and most of the equipment were quickly located and secured by April 1. Designs for the smokestack and the boiler breeching were made, and an order for their construction within strict time limits was placed with

the Steel Tank & Pipe Company of Berkeley, and a 2,500-bbl. steel oil tank with the Western Pipe & Steel Company. In fact, all but a few small parts were ordered and assured practically before work on the ground commenced, with the notable exception of a condenser. Every effort to locate a condenser, either surface, or jet, seemed doomed to disappointment. Searches through the shipyards and Government yards were unavailing. Long lists of second-hand machinery were studied in the hope that some combination could be found that would do the work, and could be installed within the time available. Finally a second-hand dealer in Oakland produced a jet condenser of proper capacity, providing a suitable removal pump could be found. Eventually after many abortive plans to make use of old apparatus, C. F. Braun & Company in San Francisco undertook to build a pump within 30 days.

Equipment Lost in Transit

As soon as the generating unit was shipped, the boilers purchased, and the fittings under construction, or ready to ship, and matters had gone so smoothly that there seemed to be no doubt as to the final successful outcome of the enterprise, the unauthorized strike of freight handlers came along. The generating unit did not arrive and so far as any one knew, was lost. In spite of frantic appeals to the railroad company to trace and locate the shipment, not the slightest information was forthcoming as to the whereabouts of the car on which it was loaded. There were two other cars, one with transformers and another with a 300-hp. motor, both vitally necessary in the maintenance of the water on the rice crop. Then the contractor employed the Pinkerton Detective Agency in Chicago to find these cars, place an operative on each and stay with them until the destination was reached, but principally to keep them moving and moving fast. Within 24 hours after this order was given, the car with the turbo-generator was located at Ft. Wayne, Ind., among thousands of other cars, where it had rested for seventeen days. Twelve and one-half days after this car was located it was delivered at its destination. Almost as good time was made with the other two cars which proved to be even more completely lost than the first. But the strike was equally as effective in California, and the problem of moving the



Does the stranger at your gate have to search for the house number?

MAKE IT AN ELECTRICAL CHRISTMAS WITH A PORCH LIGHT

machinery and materials, so easily secured at home, appeared to be most difficult. The boilers in the Oakland yard could easily be loaded, also the other apparatus, but the railroads were unable to spot the cars.

One Advantage of a Railroad Strike

At Stockton the question of obtaining firebrick in quality as well as quantity presented another



Ninety-five days after the signing of the first contract the turbine was running, and the plant operated continuously throughout the summer.

snag. It was proposed to operate the boilers, should the necessity arise, up to 70 per cent above their normal rated capacity, and this would require heavy firing. No chance could be taken with the fire resisting linings of the furnaces and it was decided to use a special firebrick, known as "Gasco XX," developed by the Stockton Fire & Enamel Brick Co., as the result of the experience of E. C. and L. J. Jones in their patented gas generators, where the most severe conditions of alternating high temperature and cooling occur. It was at this point that the strike took on a beneficial aspect,—for while the manufacturers had a sufficient quantity of this brick, it was all on order and ready for shipment, but could not be moved on account of the strike. The manufacturer agreed to let the contractor have 22,000 of the brick, provided he could move them.

The contractor, by means best known to himself, secured a couple of cars which were spotted where they could be loaded, and by the time they were moved out the strike was sufficiently lifted to keep the cars going. About the same time, the Western Pacific managed to get cars into the Moore yard, and within a day or so they moved. Then everything began to arrive at once.

Installation of the Plant

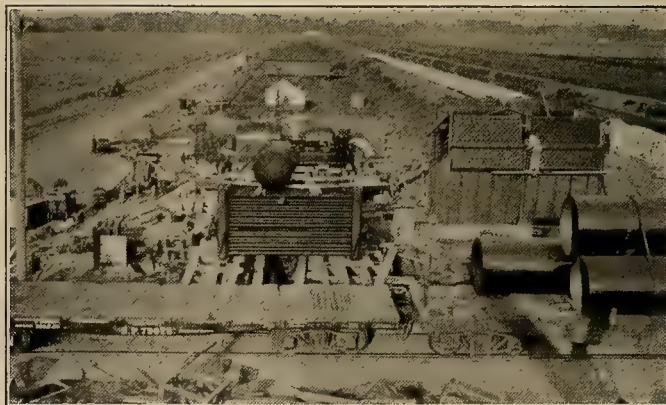
Meanwhile strenuous efforts were being made to get the foundation work started on the power plant. The deficiency in labor was acute. Only a small proportion of men who actually were obtained for the work would stay, and much of the labor obtained was of such poor quality that normal progress appeared to be impossible. High wages and the best of food and housing appeared to have no great attraction. Throughout the work from two to three hours overtime was paid almost every day. No attempt was made to erect a building until the plant should be complete and operating.

With all the many apparently insurmountable difficulties finally out of the way by June first, the plant began to assume the appearance of definite shape. On June 7, just ninety days after the signing of the first contract, steam was raised in the first pair of boilers, and on June 12 the turbine was running. There was still much to do in finishing up loose ends, and many petty annoyances developed, but the plant operated continuously from the 20th of June throughout the summer until the early rains in October brought relief to the power shortage situation. The object for which the plant was installed was fulfilled, the rice crop on the Provident and Maxwell Farms districts received a full quota of water without interruption, and what was by no means the least of the results to be obtained, the line voltage at the pumps was maintained at full value. Immediately upon completion, the plant was taken over under lease by the Pacific Gas & Electric Company and operated under their management throughout the season.

Description of Equipment

The generating unit, furnished by the Ridgway Dynamo and Engine Company, consists of a steam turbine of the Rateau type, a generator of the conventional enclosed induced-air-cooling type, and a direct connected exciter, all mounted on a heavy girder frame bedplate. The turbine has a maximum output of 2400 hp. and is operated at 3600 r.p.m. It is equipped with air and oil pressure governor, motor controlled, with automatic runaway stop. The high pressure glands are steam sealed and carbon packed, while the low pressure glands are water sealed and are packed by centrifugal action.

The generator is rated at 1500 kw., or 1850 kva., and will carry 10 per cent continuous overload based on a 55° temperature rise. The output is 3-phase and 60-cycle at 2400 volts. Air is drawn through the ends of the rotor and discharged through the center at the bottom and thence through a door in the side of the building. The incoming air enters a large box-like structure in which three sides and the



The plant is located close to the main canal of the Provident District, and the condenser cooling and boiler feed water is drawn directly from the canal.

bottom have cheesecloth covered screens with a superficial area of 144 sq. ft. This filter box is placed outside the building. A galvanized iron flue 4½ ft. wide by 24 in. deep conducts the cool air to the intake opening under the generator.

The switchboard consists of a single Westinghouse slate panel containing main circuit-breaker, a.c. and d.c. ammeters, voltmeter, indicating and integrating polyphase wattmeters, rheostats, etc. Three 3-kw. 2200-220-110-volt General Electric station transformers provide current for lighting and the operation of the oil transfer pump and a sump pump, of 5 hp. and 3 hp. respectively.

The main 2400-volt, 3-phase circuit passes from the switchboard through disconnecting switches and thence to a transmission line consisting of two circuits in parallel of 4-0 rubber covered strand copper. This circuit is carried a distance of $\frac{3}{4}$ -mile to the Sidds Landing pumping plant.

The turbine and switchboard are mounted on an elevated concrete platform at a level 7 ft. 3 in. above the main station floor. The three boilers are placed



The smoke stack was shipped in three pieces, riveted together on the ground, and tipped up into place by the use of shear-legs and a heavy back-tackle.

in a line, two on one side and the third on the opposite side of the smokestack. Two horizontal breechings made of $\frac{3}{16}$ -in. steel plates and braced with steel angles, fitted with dampers, connect from the smoke openings on the tops of the boilers into the smokestack, on opposite sides. The smokestack is 101 ft. in height from the floor and 5 ft. internal diameter, and is built of $\frac{3}{16}$ -in. steel plates. The smokestack was shipped in three pieces, riveted together on the ground and tipped up into place by the use of shear-legs and a heavy back-tackle.

The boilers are the Heine standard cross-drum marine type, rated, on a basis of ten sq.-ft. heating surface per boiler horsepower, at 278 hp. each, and are not to be confused with boilers built on the Pacific Coast for the United States Shipping Board and known as "Heine type," or, "Foster," boilers. Each is equipped with a 42-in. cross-drum on which are mounted duplex safety valves, superheater and auxiliary 4-in. angle valves, 10-in. steam gauge, cocks, blow-off and double water inlets. These boilers are built in accordance with Lloyds, U. S. S. B. and A. S. M. E. standard specifications to carry 225 lb. working pressure. In this installation, 175-lb. pressure was adopted, and with this pressure it is possible to obtain a maximum of 100° superheat.

Especial attention was given to the design of the furnaces, aside from the careful selection of the insulating materials, in that an additional foot of furnace height was given over the standard design

used on board ship. Inside the firebrick lining and between it and the steel shell is a layer of $\frac{1}{2}$ -in. asbestos millboard and $2\frac{1}{2}$ -in. thickness of silocel brick. The upper and lower baffles are of fire-clay tile, while the center baffle on two of the boilers is of segmental cast iron tile and on the third boiler is a $\frac{1}{4}$ -in. steel plate. Each boiler is equipped with three G. H. Witt outside mix steam oil-burners, and these are supplied with fuel oil from a standard Witt double duplex steam pump set with exhaust steam oil-heater.

Oil and Feed Water Supply

In order to deliver fuel oil a spur track connecting with the Colusa & Hamilton branch of the Southern Pacific was installed. Oil cars are spotted over a concrete sump under the track. A 4-in. Gould rotary pump driven by a 5-hp. motor placed on the main station floor under the generator, convenient for attention from the operators and yet out of the way, pumps the fuel oil from the track sump into a 2500-bbl. fuel storage steel tank. There are two McGowan, simplex vertical Marine type, 10-in. by 6-in. by 12-in. boiler feed pumps, each having a capacity of 54 gal. per min., or sufficient to supply feed water for the full plant capacity. Warm water from the condenser discharge is delivered into an 800-gal. hotwell filter tank and from this tank the feed pumps force the boiler feed water through a Braun horizontal closed-type heater into the boilers. The plant is located alongside the main Provident District canal, and the condenser cooling and boiler feed water is drawn directly from the canal.

Steam Piping

There is a double system of steam piping, the one consisting of the main lines carrying superheated steam from the superheater outlets to the turbine, while the other is an auxiliary system taking saturated steam from the boiler drums and supplying all auxiliary apparatus. There is an emergency cross-connection between these systems of piping so that, in the event of superheater trouble, steam for the turbine may be drawn directly from the boilers. The superheated steam pipe lines are of 6 in., and 4 in., extra heavy welded steel pipe with VanStone joints and steel flanges. There are two 4 in., main Chapman steel-body gate valves equipped with Monel metal discs and seats, on each boiler feeder and one on the emergency crossover, making seven valves in all. The auxiliary steam lines are 4 in., extra heavy pipe, there being two high-pressure ferro-steel valves on each boiler lead. The piping, including long radius bends and VanStone (Crane-lap) joints, was furnished and fabricated in San Francisco by the Crane Co., on a 30-day delivery contract, and it is of interest to note that this ma-



Do you have to get up early on frosty mornings to fix the furnace?

MAKE IT AN ELECTRICAL CHRISTMAS WITH AN ELECTRIC FURNACE REGULATOR

terial was shipped complete in 25 days after the order was received.

Exhaust steam, after leaving the turbine, passes through a 36-in. elbow, built of 5/16-in. steel plates, lap-welded to insure vacuum tight joints, to the condenser. A lateral outlet in this elbow terminates in an up-rise on which is mounted a 24-in. water-sealed atmospheric relief valve, above which is a 24-ft. length of 24-in. steel exhaust pipe. A Blake-Knowles jet condenser of the low-level counter-current type, receives cooling water from the canal and discharges it together with the condensate through its lower end into the removal pump, which is driven by a 60-hp., 2200-volt induction motor.

Design of Building

The building, which was erected after the plant had been placed in operation, is covered with galvanized corrugated iron. It has a high clerstory roof to facilitate ventilation. The framework is of timber, carefully designed to withstand the heavy winds which are sometimes experienced at this point. The roof trusses are of an unusual design in order to span the boiler breeching without giving undue height to the sidewalls. The order for six trusses was given to the Palm Iron Works of Sacramento on a Monday morning, after which they were detailed, the material ordered and received, the trusses fabricated and painted and delivered at the plant on a Saturday, twelve days later, after which they were assembled and erected without a change, or a misfit.

ARC WELDING OUTFIT FOR TAPPING WATER MAINS

To avoid the necessity of shutting the water off from customers who require it continuously for irrigation, the city of Los Angeles has turned to the use of an arc welding outfit for tapping mains. The set consists of a portable d.c. generator driven by a gasoline engine, the whole mounted on a motor truck.

Heretofore the practice has been to parallel the larger mains with smaller ones which could be shut off and emptied in order to make service connections. This was expensive and often it was necessary to shut off the mains up to 72 in. in diameter, drain them, with a loss of a large amount of water, and then make the service. Under the system now in effect the welding outfit is taken to the job and makes the connection in four hours' time, thus making a great saving in time and material.

The procedure is to turn down in a lathe and grind on an emery wheel the size of pipe desired. The end of the pipe is polished for two inches and beveled to an angle of 60 degrees. When taps to small diameter mains are to be made the service pipe is ground to fit the curvature of the main.

Before starting the job of welding the main is polished with an emery wheel to effect an easier bond. The coupling is then spot-welded and the first layer of metal applied. Considerable skill is required in handling the arc when depositing the first layer, but successive layers can be put on quite easily. The hole in the main is made in the usual way.

The welding unit consists of a 20-kw. d.c. generator driven by a six-cylinder gasoline engine which also drives an air compressor which supplies air for



Welding a 4-in. connection to a 60-in. riveted steel main. The picture was taken entirely by the light from the arc.

testing the connection after welding. The engine is supplied with a special governor to give the requisite steadiness in voltage. The panel on which switches and controls are mounted is built up on a small platform supported on wheels so that it can be taken to any desired part of the work.

The outfit was developed by S. B. Brown, an electrical engineer of Los Angeles. The above infor-



Portable arc-welding outfit for making connections to water mains without draining the water from the mains.

mation as to the details of design and operation were supplied by H. A. Van Norman, assistant engineer of the Department of Public Service, City of Los Angeles.

LARGEST ROLLING MILL IS ELECTRICALLY DRIVEN

What is claimed to be the largest rolling mill in the world has recently been placed in service at Dorman & Long's Warrenby mills near Durham, England. The installation is electrically driven, involving 20,500 hp. in motors.

Problem Course in Electricity

BY H. H. BLISS

(Why must you have heavier service wires in your home if you install an electric range and a number of the large appliances? The following article, the tenth of a series, takes up the calculation of wire thicknesses and resistances. The author is on the staff of the Riverside Junior College at Riverside, California.—The Editor.)

WIRE SIZES AND RESISTANCE

Mils and Circular Mils.—Since nearly all electric wires are much less than an inch in thickness, it is not convenient to express their diameters and cross section areas in the usual units, inches and square inches. We use the "mil" as the unit of measure

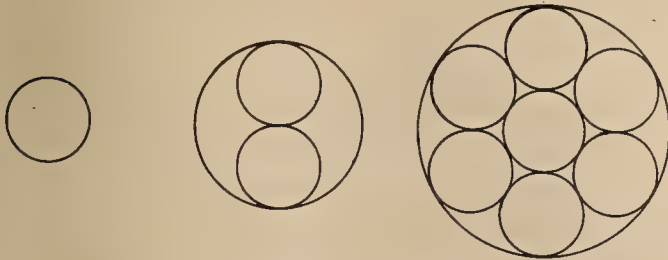


Fig. A.—Enlarged diagram showing that a circle 2 mils across has a much greater area than two one mil circles.

for diameter, one mil being 1/1000 of an inch just as one "mill" represents 1/1000 of a dollar in our monetary system. Then a half-inch wire is said to have a diameter of 500 mils; 1/10 of an inch is 100 mils; .037 inch = 37 mils.

If a one mil wire were cut square across it would present a circular cross section of which the area is said to be one "circular mil." The circular mil thus defined serves as the unit of cross section area in all wire computations.

If a wire 2 mils in diameter were cut across, would it present an area of 2 C. M. (circular mils)? The enlarged diagram of Fig. A shows that a circle 2 mils across has an area much greater than two one mil circles; in fact it contains as much as four circular mils. The three mil circle contains 7 complete circles of one mil diameter with enough extra space to equal two more. The general rule is that the C. M. area of any circle equals the square of its diameter (this last being, of course, expressed in mils). Thus, No. 30 wire which is 10 mils thick has a section area of $10^2 = 100$ C. M.

What is the area of a wire $\frac{1}{4}$ -inch in diameter, and what is the diameter of a wire with twice that area? Since $\frac{1}{4}$ -inch = 250 mils, the first answer is $250 \times 250 = 62,500$ C. M. Then $2 \times 62,500 = 125,000$ and the diameter of the second wire is the square root of $125,000 = 354$ mils.

Resistance of Copper Wires.—If nine one-mil wires were laid together into a cable, it would have a cross section equivalent to that of a wire three mils in diameter. A three-mil wire, then, has the same resistance as 9 one-mil wires in parallel, or 1/9 the resistance of one of them. Similarly a wire of 26,250 C. M. area (No. 6) has a resistance of 1/26,250 of that of a one-mil wire of the same length.

Hence, to find the resistance of any wire, divide the resistance of an equal length of 1 C. M. wire by the C. M. of the given wire.

A piece of copper wire of 1 C. M. cross section and 1 foot long has a resistance of about 10 ohms at a temperature of 50° F. Therefore the resistance of any length of such wire = $10 \times$ the number of feet, since each separate foot is in series with all the others. The relations of length and size to resistance are conveniently expressed as follows:

For any copper conductor the resistance is approximately equal to $10 \times$ the length in feet \div the cross section in C. M.

Rectangular Conductors.—In Fig. B are shown conductors of shapes different from the round form usually met with. Square, rectangular and flat conductors are used in winding armatures and field coils, for bus bars and for other carriers of heavy currents for short distances. The resistances of such con-

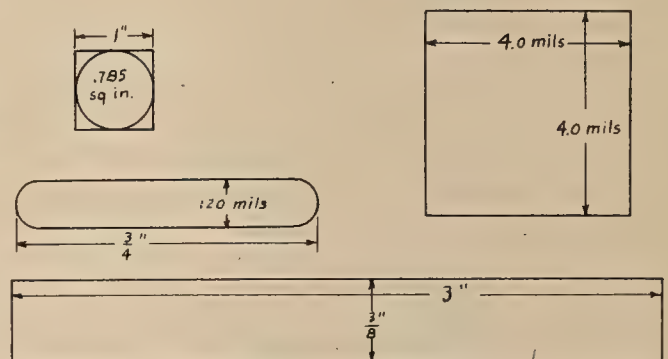


Fig. B.—In this cut are shown square, rectangular and flat conductors which differ from the more familiar round form.

ductors must be calculated from section area and length.

Since any circle has an area .785 as large as that of a square of the same dimensions (see Fig. B), one circular mil is .785 of one square mil. The square conductor in Fig. B has an area of $40 \times 40 = 1600$ sq. mils; $1600/.785 = 2040$ C. M. The $\frac{3}{8}$ in. \times 3 in. rectangle (the cross section of a bus bar in a power house) has $375 \times 3000 = 1,125,000$ sq. mils or 1,432,000 C. M. The remaining shape in Fig. B may be analyzed as a rectangle plus a circle; its area = $120 \times 630/.785 + 120^2 = 110,700$ C. M.



Is your wife nervous over the possibility of a man under the bed?

MAKE IT AN ELECTRICAL CHRISTMAS WITH AN ELECTRIC BURGLAR ALARM

Wire Table.—Below is a table giving the most important figures relating to round copper wires of various sizes from No. 0000 to No. 40. The resistances are given for wires at a temperature of 68° F. and these figures are not exact for any other temperature. All metallic wires increase in resistance as they become warmer. The attached list of multipliers will enable one to correct the tabulated figures for various temperatures up to 200° F. The ohms

How long a piece of No. 30 copper will be needed to make a resistance of 8.446 ohms? One foot has .103 ohm (from table); hence 8.446/.103 or 82 feet is the length required.

What size copper wire should be used if the resistance of 150 feet is not to exceed .111 ohm? The ohms per foot = .111/150 = .00074; hence there is .74 ohm per 1000 feet. Referring to the table we see that No. 9 has .7908 ohm per 1000 feet, and No.

WIRE TABLE

COPPER						ALUMINUM					
Gage Number B&S	Diameter in Mils	Area in Cir. Mils	Ohms per 1000 Feet	Lbs. per 1000 Feet	Safe Amps. Other Ins'n	Safe Amps. Rubber Ins'n	Ohms per 1000 Feet	Lbs. per 1000 Feet	Safe Amps. Other Ins'n	Safe Amps. Rubber Ins'n	Gage Number B&S
0000	460.0	211600	.0489	640.5	325	225	.0804	192.0	273	189	0000
000	409.6	167800	.0617	508.0	275	175	.1014	152.3	231	147	000
00	364.8	133100	.0778	402.8	225	150	.1278	120.8	189	126	00
0	324.9	105500	.0981	319.5	200	125	.1610	95.9	168	105	0
1	289.3	83690	.1237	253.3	150	100	.2032	76.0	126	84	1
2	257.6	66370	.1560	200.9	125	90	.2562	60.2	105	75	2
3	229.4	52630	.1967	159.3	100	80	.3230	47.8	84	67	3
4	204.3	41740	.2480	126.4	90	70	.4075	37.9	75	59	4
5	181.9	33100	.3128	100.2	80	55	.5140	30.0	67	46	5
6	162.0	26250	.3944	79.46	70	50	.6480	23.8	59	42	6
7	144.3	20820	.4973	63.02			.8171	18.9			7
8	128.5	16510	.6271	49.98	50	35	1.050	15.0	42	29	8
9	114.4	13090	.7908	39.63			1.300	11.9			9
10	101.9	10380	.9972	31.48	30	25	1.640	9.42	25	21	10
11	90.74	8234	1.257	24.93			2.068	7.47			11
12	80.81	6530	1.586	19.77	25	20	2.605	5.93	21	16	12
13	71.96	5178	1.999	15.68			3.284	4.71			13
14	64.08	4107	2.521	12.43	20	15	4.250	3.73	16	12	14
15	57.07	3257	3.179	9.86			5.111	2.96			15
16	50.82	2583	4.009	7.82	10	6	6.591	2.34	8	5	16
17	45.26	2048	5.055	6.20			8.315	1.86			17
18	40.30	1624	6.374	4.92	5	3	10.49	1.47	4	2.5	18
19	35.89	1288	8.038	3.90			13.60	1.17			19
20	31.96	1022	10.14	3.08			16.66	.929			20
21	28.46	810	12.78	2.45			21.03	.737			21
22	25.35	642	16.12	1.95			26.51	.581			22
23	22.57	509	20.32	1.54			33.42	.464			23
24	20.10	404	25.63	1.22			42.15	.367			24
25	17.90	320	32.31	.970			53.17	.291			25
26	15.94	254	40.75	.769			67.05	.230			26
27	14.20	201	51.38	.610			84.50	.183			27
28	12.64	160	64.79	.484			106.5	.144			28
29	11.26	127	81.70	.384			134.4	.116			29
30	10.03	100	103.0	.304			169.3	.091			30
31	8.93	80	129.9	.241			208.6	.072			31
32	7.95	63	163.8	.191			269.5	.057			32
33	7.08	50	206.6	.152			339.6	.045			33
34	6.31	40	260.5	.120			428.5	.036			34
35	5.62	32	328.4	.096			540.0	.029			35
36	5.00	25	414.2	.076			681.0	.023			36
37	4.45	20	522.2	.060			858.9	.018			37
38	3.97	16	558.5	.048			1084	.014			38
39	3.53	12	830.4	.038			1366	.011			39
40	3.15	10	1047.0	.030			1722	.009			40

per C. M. foot for copper wire at these temperatures are also given. It will be noted that this number rises to 12 ohms before the temperature reaches 150°. Hence design calculations are often carried out on a basis of 1 ohm per C. M. inch.

Temperature of Wire	80°F.	90°F.	100°F.	150°F.	200°F.
Multiply res. at 68° by	1.024	1.044	1.064	1.164	1.264
Ohms per C. M. ft. copper	10.65	10.87	11.08	12.11	13.17

Using the Table.—To find the resistance of a piece of wire of any length, find the ohms per 1000 ft. from the table and divide by 1,000 (simply move the decimal point three places to the left). This gives the resistance of one foot of wire. Multiplying by the length of wire (in feet) gives the resistance.

For example, the resistance of 700 feet of No. 4 copper wire = 700 × .000248 = .1736 ohms. And 25 feet of No. 22 copper wire will have a resistance of 25 × .01612 = .403 ohms.

8 has .6271. Evidently No. 9 has too much resistance. Answer, No. 8.

In such problems always select wire of the next size larger.

A motor taking 40 amperes is 208 feet from the generator. What size copper wire is needed if the line drop must not be greater than 6 volts? The resistance must not exceed 6/40 or .15 ohm. Noting that we must use 2 × 208, or 416 feet of wire, we see that the ohms per 1000 ft. = 1000 × .15/416 = .361 ohm. Hence we select No. 5 with .3128 ohm per 1000 ft., as No. 6 has too high resistance (.3944).

Solutions of Previous Set

98. At 40,000 it takes 12,500/80 = 156 times as many ampere-turns for air as for cast iron, hence the cast iron has permeability = 156. At 70,000 wrought iron has 1608, cast steel has 1045, sheet steel has 2090.

99. Half way between 40 and 80 is 60 ampere turns for the cast iron. For the cast steel, .3 of the difference between 28 and 43 is 12, and 28 + 12 = 40; for the sheet steel, .2 of the difference between 32 and 80 is 10, and 32 + 10 = 42.

100. Armature: density = 90,000; $3 \times 43 = 129$ ampere-turns. Air gaps: density = 45,000/.7 = 64,300; $2 \times .025 \times 64,300/3.2 = 1003$ ampere-turns; magnet: density = $1.55 \times 64,300 = 100,000$; $8 \times 80 = 640$ ampere-turns. Total = 1772 ampere-turns.

101. Area = 1.54 sq. in.; density = 78,500/1.54 = 51,000. Pull = $1.54 \times 51,000 \times 51,000/72,000,000 = 55.6$ lbs.

102. Area = .95 sq. in.; density = 78,500/.95 = 82,600. Pull = $.95 \times 82,600 \times 82,600 \div 72,000,000 = 90$ lbs.

103. Air gaps: area = 3.14; ampere-turns = 750. Armature: density = 83,300; ampere-turns = $6 \times 22 = 132$. Poles: ampere-turns = $20 \times 18 = 360$. Yoke: density = 35,000; ampere-turns = $6 \times 60 = 360$. Total = 1602 ampere-turns.

104. Poles: density = 91,000; ampere-turns = $20 \times 34 = 680$. Yoke requires $6 \times 80 = 480$ ampere-turns. Armature and air gaps as before. Total = 2042 ampere-turns.

105. Area = .675 sq. in. Density \times density = pull \times 72,000,000/area = $15 \times 72,000,000/.675 = 1,600,000,000$. Hence density = 40,000 and total flux = 27,000 lines.

106. Gaps need $2 \times .02 \times 12,500 = 500$ ampere-turns. Armature needs $4 \times 103 = 412$; gaps and armature need 912 ampere-turns.

107. 2730 — 912 = 1818 ampere turns required to drive the flux 13 in. through the cast iron, or 140 ampere-turns per inch. From the table, this indicates a flux density of 50,000. Leakage coefficient = $50,000/40,000 = 1.25$.

108. A guess that the total flux = 160,000 gives ampere-turns = 1302. A revised estimate of 200,000 gives 2210 ampere-turns, the correct number. Hence the answer is 200,000.

Copper Wire Problems

109. What are the section areas of round wires of the following diameters: 60 mils, $\frac{1}{4}$ inch; 2.2 inches?

110. Find the diameter of a special copper wire 4000 ft. long, which has a resistance of 400 ohms at 50° F.

111. What is the resistance at 80° F. of a copper wire .3-inch in diameter and 7300 feet long?

112. Find the section area in sq. mils and C. M. and the resistance per 1000 ft. of a rectangular copper conductor 1/16 in. by 7/8 in. (Assume 50° F. in this and similar cases where temperature is not stated and tabular figures are not available.)

113. A square wire 860 ft. long has a resistance of .3 ohm. Find section area and thickness of the conductor.

114. What is the diameter of a round wire 5 in. long which has a resistance of .0745 ohm?

115. Find the resistance of 1000 ft. of No. 16 copper wire at 90° and 200° F.

116. What is the length of a piece of No. 2 copper wire which has .0343 ohm resistance at 68° F.?

117. Find the gage number of a copper wire 370 ft. long which has 24 ohms resistance at 68°.

118. 250 ft. from a 104-volt generator is a 10-hp. 100-volt motor of 75% efficiency. What size copper should be used for transmitting the current?

119. Each of the three conductors in a copper cable across the Golden Gate contains 250,000 C. M. in 37 strands. Find the diameter and resistance of one strand, the length being 26,775 ft. and the temperature 50° F.

120. What is the voltage between a pair of No. 13 copper wires 26,775 ft. from an applied voltage of 40, if the current flowing is .3 ampere? (Assume 68° F.)

121. A magnet coil has an average diameter of 4.2 in. and contains 360 turns of No. 18 wire. Volts applied to coil = 22. The temperature being 100° F., find the ampere-turns and the watt loss in the coil.

Pamphlets and Clippings in a Business Library

BY VIRGINIA FAIRFAX

(Are you wondering what to do with that ever-growing collection of clippings and pamphlets? The librarian of the Carnation Milk Products Company makes their segregation a simple matter if instructions are followed. Permission to reprint from this series must be obtained from the Journal of Electricity.—The Editor.)

THE FILING EQUIPMENT NEEDED

In order properly to install vertical files of pamphlets and clippings, it is most economical and satisfactory to purchase at the start the filing equipment and supplies that, through use and experience in business libraries, have been found most satisfactory.

The requirements are, one or more filing units, or filing cabinets; substantial folders, heavy manila envelopes and possibly a set of guides; 3 by 5 inch catalog or index cards; a 3 by 5 inch card tray cabinet to hold the cards, and gummed name labels for marking the folders.

Vertical Unit Cabinets

The vertical files are built in units, three or four drawers high with removable sides so that the files may be expanded by the addition of other units as the collection of pamphlets grows. These filing units or cabinets, adequate for filing pamphlets and clippings, may be purchased in two sizes. The correspondence size drawers are 10½ inches high, 12 inches wide and 24 inches deep, inside measurements. The legal size is much more desirable for pamphlets and clippings because this size drawer gives more filing space, in that the average size pamphlets stand side by side in an upright position, without lapping, and the large pamphlets or oversize booklets are accom-

modated as well as reports on legal size paper, without folding. Correspondence size units occupy less floor space but the drawers do not hold as much material as the legal size, and more drawers of the correspondence size are eventually required. Therefore there is no saving either of floor space or of money by the purchase of the smaller size.

Vertical filing cabinets are manufactured in wood and steel by all of the well known manufacturers of office equipment and supplies, such as the Library Bureau, Yawman & Erbe Manufacturing Company, the Globe Wernicke Company, Shaw Walker Company, Art Metal Construction Company, The Macy Company, etc. There is no advantage in purchasing steel files for material of this character, unless floor space is very limited. It is claimed that a half-inch is saved on every steel unit over the wood units. Wood files harmonize better with the other office furnishings and are less noisy when the



Do you have to walk upstairs in the dark to reach the light switch?

MAKE IT AN ELECTRICAL CHRISTMAS WITH A THREE WAY SWITCH

drawers are pulled and pushed back and forth, and are less expensive. The points to bear in mind in selecting the make of wood vertical files are to have them of well seasoned wood, perfectly dried, so that there will be no swelling or warping, and the drawers in either wood or steel cabinets should be mounted on roller-bearing slides so that they run easily when loaded.

Size and Quality of Folders

Folders for holding the pamphlets, and clippings too if they are not collected in great quantities, may be had in several qualities. They are made of pressboard, of manila paper and of a fiber material that is very tough and durable. The pressboard folders are made to order by any of the manufacturers of office and library supplies or any paper house, either straight edge or with tabs, and should be cut, if legal size files have been purchased, $14\frac{1}{2}$ by 10 inches with a one-inch linen bellows expansion at the bottom, the front edge of folder a half-inch shorter than the back. These make a very substantial receptacle and wear indefinitely.

The Yawmanote Filing Pockets are made of a durable fiber material and have a bellows expansion

of different widths at the bottom and about half-way up each side, making as the name implies, a pocket. These are manufactured in legal and correspondence sizes by Yawman & Erbe Manufacturing Company, Rochester, New York.

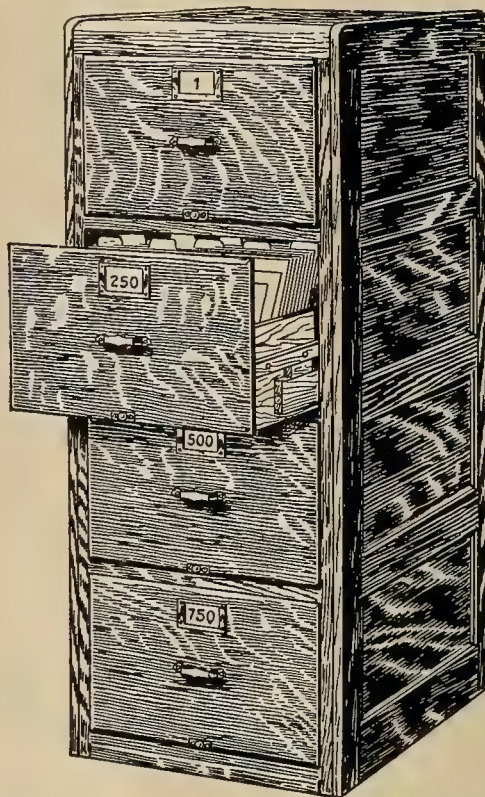
The Bushnell Vertex Paperoid File Pocket, made by the Alvah Bushnell Company, Philadelphia, Pa., and the jute and leatherette folders and pockets made by

the Library Bureau are similar to the Yawmanote filing pockets. Any of these pockets are excellent and like the pressboard folders will hold a great deal of material without sagging or getting out of shape. Manila folders may be used to hold a few pamphlets or until the collection on any particular subject grows, when the contents can be transferred to a heavier folder. The manila folders are much cheaper than these others, but they are far less durable; they sag in the file drawers and will not hold nearly as much material. They are useful, however, for a small amount of printed matter and save the more expensive folders until the collection of material warrants their use.

Binder folders are useful for holding together manuscripts consisting of a number of pages. These are light weight manila folders to which fasteners are affixed, either at the top of the folder or at the center alongside of the fold, and bind the papers in book form. The Acco Fasteners, made by the American Clip Company, New York City, may be purchased by the box or already fitted into folders.

From the Library Bureau may be purchased folders already fitted with the L. B. metal fasteners, which are similar to the Acco fasteners.

Articles of only several pages clipped from periodicals, or typewritten reports of a few pages, may

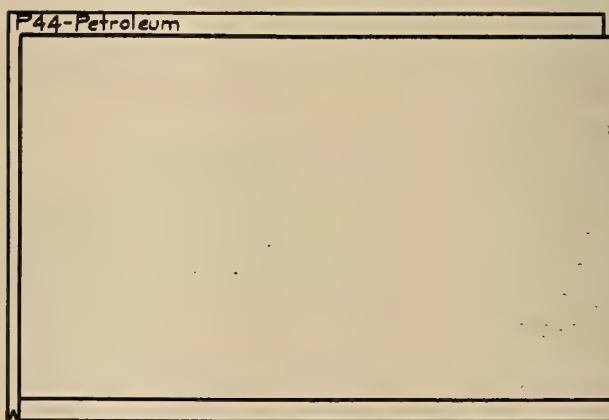


The legal size unit may be expanded by removing the sides and adding other units. Courtesy of Library Bureau.

be bound with a manuscript cover paper and clamped together, or they may be fastened into light weight manila folders with U-File-M binder strips. This latter fastener is a strip of gummed paper that is glued into the folder and has little tabs that project and are glued on to the sheets to be inserted. These hold the sheets one behind the other, like leaves in a book. They may be purchased from U-File-M Man-



Yawmanote Filing Pocket, legal size, showing bellows at bottom and sides. Courtesy of Yawman & Erbe Manufacturing Company.



Legal size pressboard folder, straight edges with one-inch bellows at bottom

ufacturing Company, Syracuse, New York. On the front cover of any of these binders should be written, or typed, the name of the article, its source and date of publication and the bound article dropped

into the heavy folder with the other material on the same subject.

This method of caring for clipped articles and manuscripts requires but a few minutes and increases the length of their durability and helps to make the files neat and a joy to use.

Envelopes Desirable for Clippings

If a great many clippings are collected it is better to keep them in heavy manila envelopes, the same size as folders, and file them immediately behind the folder holding pamphlets on the same subject. The envelope prevents unmounted clippings from slipping out into the drawer and becoming mislaid or lost. If the clippings are not numerous they should be mounted on a substantial paper, light weight manila or bond that does not tear or crumple easily, and filed in the folder with the other material on the same subject.

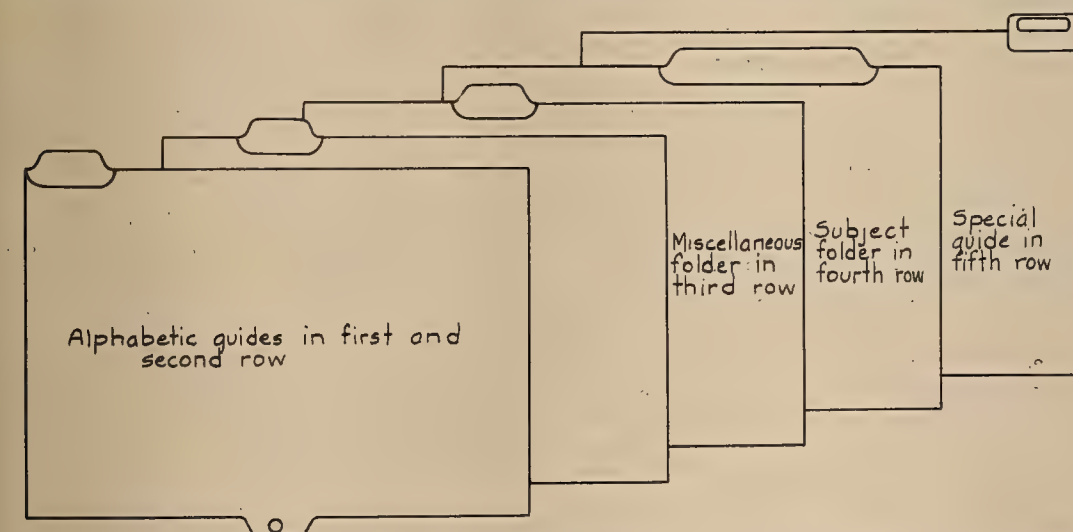
Gummed Name Labels

The gummed name labels may be purchased in five different colors. They come approximately four inches wide, ten labels to a strip, 1000 strips in a box, ruled for folding and cutting and gummed for sticking. Before cutting they may be run through a typewriter and subject name printed on them ready for pasting on the folder. These may be bought from the Library Bureau.

The Use of Guides

Two systems may be used to arrange, in the file drawers, the folders or pockets and envelopes containing the printed matter. First, in a small collec-

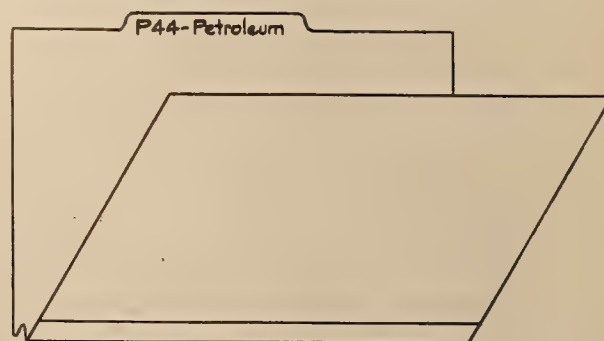
tion, guides are not necessary as the stiff pressboard folders or pockets already described, cut with straight edges and plainly marked with the subject name on the upper left hand margin, stand out plainly and are easily found. Second, where the collection is large, that is, when a number of vertical filing units are required to house the collection, guides are used to facilitate the filing and finding of the printed matter.



The tabs with alphabetic divisions should project in the first and second positions, miscellaneous folders in the third, printed matter in the fourth and special subject guides at the extreme right.

In this latter system pressboard guides with the alphabetic divisions printed on their tabs, or projections, are best arranged in two rows at the extreme left of the file drawer, that is, the tabs are cut to

stand in the first and second positions. Miscellaneous folders, when used, should have tabs projecting in the third row (the use of miscellaneous folders



Legal size pressboard folder with tab and one-inch bellows at bottom

will be explained in the next article). The folders for holding the printed matter should have wide tabs projecting in the next or fourth row and these folder tabs should be marked to indicate their contents and the folders filed behind the correct alphabetic guides. If special subject guides are required they may have tabs projecting in the fifth row, that is, at the extreme right of the file drawer.

In some business libraries it is desirable to arrange the information in the vertical files according to country. Under these circumstances, and if the collection is large, the pressboard guides with tabs cut to project in the middle row, center of drawer, have the country name printed on them. Behind each country guide the tab folders, with tabs



Does the baby turn on the gas stove when your back is turned?

MAKE IT AN ELECTRICAL CHRISTMAS WITH AN ELECTRIC RANGE

extreme left hand side, may be marked "Advertising." The second subject folder with tab cut in second position may be marked "Exchange & Credit Conditions." The third subject folder with tab in the first position may be marked "Tariffs," etc., meaning in each instance as related to France.

If a miscellaneous folder is used, it should have tab standing in the fourth row, and should be filed behind the last subject folder containing information on that country, and just in front of next country guide, which in this instance may be Germany.

Card Trays and Card Tray Cabinets

A good quality of card approximately 3 by 5 inches should be purchased, preferably of linen stock whose edges will not become soft from frequent fingering, and light enough to run through a typewriter and record made thereon. Punched cards that allow for a rod to pass through are preferable as the rods prevent spilling of contents and careless removal of cards from the trays. By no means should more than one weight of card be used in the catalog or index and to assure proper fit, cards and card tray cabinets should be purchased having same standard of measurement. That is, some manufacturers cut their card stock and make their card trays with the centimeter, and also with the inch, as a basis of measurement, and others with only the inch as a basis. The slight difference between the centimeter and the inch will cause a great deal of annoyance in fingering cards or an absolute misfit in card trays not made to the same measure. Therefore the measurement desired must be specified and adhered to.

Card tray cabinets may be purchased with one, two or more drawers from any of the manufacturers of office equipment and supplies.

TESTING ELECTRIC WELDS

The question of testing welds was interestingly treated in a paper read recently by S. W. Miller before the Chicago Section of the American Welding Society. Some of the points brought out were as follows:

Soundness in a weld means freedom from mechanical imperfections such as lack of fusion, the presence of films or other inclusions, gas pockets, slag, etc. While no one method of test shows everything desired to be known about a weld, the microscope is particularly valuable in investigating the formation of metals, and therefore of a weld, which is subject to all the defects found in castings.

It is not universally known that a comparatively small difference in the percentage of carbon in the material being welded makes a very great difference in the results of either a bend or a tensile test. The higher the carbon the more difficult it is to get a satisfactory weld, and the more danger there is of injuring the metal being welded. A weld made with a given welding rod or electrode can have only a given strength. If this strength is greater than that of the material being welded, the test piece will always break outside of the weld. If, on the other hand, the weld is weaker than the material being welded, the rupture will always take place in the weld.

The method of test to be applied in any given case depends largely on the use to which the welded piece is to be put. One of the best tests to determine quickly the general

character of a weld is to grind it off level with the surface of the pieces and clamp it on an anvil, the bottom of the V toward the anvil so that the top of the weld is stretched when the projecting end is struck with a sledge. The blow should not be too heavy, and the number of blows and angle to which the piece bends before cracking are quite a good index of the value of the weld. It is true in this test as in the tensile tests, that the quality of the material being welded has a great influence on the results, stiff material throwing off more of the strain into the weld, while soft ductile material will itself take considerable of the bend. In the case of defective welds, those not fused along the V or which contain slag or other inclusions, this test will at once develop defects. If a welded piece were to be used in a place where it might become red hot, it would be entirely proper to test the weld at a good red heat. If welds are made in half-inch by two-inch bar steel, a 90 degree single V being used, and they bend to a right angle cold without cracking on the outside, a welder may feel well satisfied with his work.

In many cases, the defects in welds are easily visible to the naked eye when tested. In other cases they are not. There has recently been developed an etching method for testing steel rails for hidden defects. For instance, a section of a weld might be cut out with a hack saw, machined or filed to a true surface, and polished on various grades of emery paper. It is then placed in a warm solution of 25 per cent hydrochloric acid and water for about an hour. The acid will eat away the defects, making the edges of the material taper, so that rather large grooves and pits will be visible where the defects prior to the etching would be only microscopic.

Some of the defects in welds are visible under the microscope but others are not visible until the weld is strained. A small bending machine that can be placed on the microscope stage is very useful, because after etching the piece can be bent and examined to see the effect of the strain. In the case of bare wire electric welds, the ruptures seem always to occur at the grain boundaries, even where no defects are visible there at the highest powers of the microscope.

The most important refined tests are the tensile and alternating stress tests. The tensile test can be made in any shop provided with the usual tensile testing machine. The alternating stress test is not as yet standardized even for unwelded material.

A great deal may be learned from the appearance of a weld. The appearance in a weld of porosities on top indicates that the metal has been overheated. Inasmuch as it would seem that the serious defects in welds are caused by oxides, it would appear wise in the case of gas welding to use no larger tip than is necessary to produce thorough fusion. This means that the catalogue speeds of welding are impossible if good welds are desired. The same thing is true of electric welds.

It has been found in a number of cases that very great improvements in the quality of the work were made by using regularly the bending test above described, and by carefully instructing the welders until they were able to make welds that would meet this test with unfailing regularity.

COURSE IN BUSINESS MANAGEMENT AND ORGANIZATION

The Extension Division of the University of California announces a correspondence course designed to give the business man an insight into those methods of business management and organization which he may profitably introduce into his own concern. Oscar Eugene Mack, manager export division, George F. Eberhard Company, San Francisco, has prepared the course and conducts it.

SPARKS—Current Facts, Figures and Fancy

(The electric ship, the ostrich egg, the wireless telephone and African electrification are among the features of this page. Here you will also learn of the Cloudster, the tomato-pepper and the latest application of volcanoes to industrial uses.—The Editor.)

The Montana Power Company is planning to install wireless telephones for communication between its eleven power plants which can be used in case of line trouble.

* * *

Volcano power is being contemplated by the people of Hilo who believe that the pent-up gases of the great Kilauea have limitless possibilities for industrial power purposes.

* * *

With eggs at ninety cents a dozen, why not feature the ostrich? This generous creature lays an egg which equals twenty-two of the chicken variety. A two-dollar egg is worth considering.

* * *

There are times when one might use water power direct rather than the result of a plant and transmission lines. In Europe a water-power method has been invented for breaking down rock in masses instead of crumbling it with blasting.

* * *

Since the world's paper supply is ever decreasing and the rice supply is ever increasing it has been decided to make paper from rice straw. A combine of Dutch paper manufacturers is planning a factory in the Dutch East Indies for the manufacture of paper.

* * *

The wonders of the by-product will never cease. Nothing less important than alcohol for motor fuel is being manufactured from the pineapple waste in the Hawaiian Islands. From 350 pounds of waste resulting from the canning process, two gallons of alcohol are obtained.

* * *

The long-looked-for electrically driven passenger vessel has become a reality according to a report that the Cuba, electrically driven, electrically lighted and with electrically driven winches, has successfully passed her dock trials and is ready to sail with her quota of 250 first class cabin passengers.

* * *

"The Cloudster," not the Roadster or the Speedster, is the latest in high class transportation. The Cloudster which is being manufactured in Los Angeles carried a pilot, seven passengers and 1500 pounds of mail and fuel, and has shown that she can go at a speed of 150 miles an hour and to an altitude of 18,000 feet.

* * *

Everyone speaks of the house shortage in more or less agitated tones and at least Fresno is doing her best to overcome it. Her bank clearings for October show an increase of more than \$9,000,000 over the preceding month and her building permits

for the year promise to exceed the total for last year by more than a million dollars.

* * *

Although food is not generally considered a technical subject, we feel that the production of such as the "tomato-pepper" requires enough science to warrant mention on this page. Luther Burbank announces that by January 1 he will be ready to offer the delectable tomato-pepper as well as the ever-bearing strawberry for our pleasure.

* * *

The Japanese prefer talking to the dots and dashes system, according to a recent report that the Ministry of the Navy has ordered that the entire fleet be equipped with wireless telephones and that the navy is no longer to depend on wireless telegraphy. Wireless telephony has already been installed in vessels of a unit of the First Squadron.

* * *

Since level stretches and widely scattered communities make Australia the most opportune spot in the world for aerial development, no less than 600,000 pounds sterling appears on the estimates of the Federal Government of that country for aviation. Of this amount 100,000 pounds will be spent on the encouragement of civilian aerial transport.

* * *

A more complete report of the recent test given the freshmen of thirty-eight technical colleges under the auspices of the Society for the Promotion of Engineering Education, shows that California may be credited with both first and second honors. The University of California stood second rather than first, as reported on this page November fifteenth, the California Institute of Technology standing first and Cornell University third.

* * *

Unless one is absolutely up-to-date on the subject of Africa, it seems a bit incongruous to read of plans for railway electrification in that land of elephants and jungles. Nevertheless, it is true that railway authorities intend to proceed at once with the electrification of the Cape Town-Simonstown suburban line as well as the Natal main line from Durban to Pietermaritzburg. Two large coal-burning power stations at Cape Town and Durban will be required in connection with the electrification scheme.



Do you have to stop in the middle of a dance to wind the Victrola?

MAKE IT AN ELECTRICAL CHRISTMAS WITH AN ELECTRIC PHONOGRAPH

PERSONALS

Herbert C. Hoover, president of the American Institute of Mining Engineers, has been elected president of the Federated American Engineering Societies at the recent convention of that body. Mr. Hoover graduated from Leland Stanford Junior University in 1895 and gained considerable reputation as a mining engineer, having in his charge large mining interests all over the world. At the outbreak of the war he was chosen as chairman of the American Relief Commission and had charge of the Commission for the Relief in



Belgium. Demonstrating his ability as an executive in these positions, he was appointed United States Food Administrator in 1917 when the United States entered the war. At the last convention of the American Institute of Mining and Metallurgical Engineers he was chosen as president and his recent election to lead the newly formed Federated American Engineering Societies shows the confidence of the engineers in his ability as a leader and executive. The importance to the West of Mr. Hoover's election is apparent when it is remembered that he is a Western engineer understanding the problems of the engineers in the West, and now has the position to use that understanding for the benefit of engineers and for the West.

J. Otis Burdige, formerly with the Emergency Fleet Corporation, has recently become a member of the Valuation Department of the Pacific Gas & Electric Company, San Francisco.

Thomas A. Edison has received the Distinguished Service medal, accompanied by a letter from Secretary of the Navy Daniels, in recognition of the service he has rendered during the past war.

R. A. Schuyler has been appointed manager of the Bozeman, Mont., branch office of the Montana Power Company. Mr. Schuyler was formerly in the operating and engineering department of that company. He has been in their employ since 1912.

O. O. Alenderfer, formerly in charge of commercial sales of the Rogue River division of the California-Oregon Power Company, has resigned and entered into partnership with Mr. A. B. Cunningham, in the firm of the People's Electric Store at Medford.

C. E. Rogers, of the equipment department of the Pacific Telephone & Telegraph Company, San Francisco, has returned from an extended visit to New York and Chicago, where he has been studying problems connected with the installation of fully mechanical telephone switchboards.

A. W. Leonard, Seattle, president of the Puget Sound Power & Light Company, of the Stone & Webster interests, and **D. C. Barnes**, manager of the Seattle division of the same corporation, left Seattle on November 13 on a combined business and pleasure trip to New York and Boston.

V. Dell Butler, formerly first operator in the steam plant station of the Portland Railway, Light & Power Company, Portland, Oregon, has been transferred to the post of superintendent of the Bull Run 15,000-kw. hydro generating plant of that company, located on Bull Run river east of Portland.

R. W. Muller, of the Operation and Maintenance department of the Panama Canal, is back again in San Francisco. For a number of years Mr. Muller was connected with the Pacific Gas & Electric Company at the Electra plant, and also prior to that time at the Drum Power Station.

Robert Sibley, editor of the Journal of Electricity, has been appointed a member of the Executive Committee of the Pacific Coast Section, N. E. L. A., to represent the Technical Press. He is taking the place of W. M. Deming who has gone to Tennessee to attend to business matters of his own.

L. T. Merwin, who was appointed assistant general manager of the Northwestern Electric Company at Portland, Ore., a short time ago, has now been made vice-president and general manager of that company. The story of Mr. Merwin's work in the electrical industry was told along with the announcement made in the October issue of the Journal of Electricity.

R. H. Ballard, **S. M. Kennedy** and **H. A. Barre**, of the Southern California Edison Company, were guests of the Associated Chambers of Commerce of the San Gabriel Valley at the regular monthly dinner, November 9. They spoke to the meeting on the future of hydroelectric power in California and illustrated their remarks with stereopticon slides of various Edison power properties in the high Sierras.

William Stranahan, civil engineer, who has been in the employ of the San Joaquin Light & Power Corporation since 1909, has severed his connection with that corporation and will become Fresno county representative on the California State Irrigation Association board. This association is interested in the development of the Colonel R. B. Marshall scheme to reclaim 12,000,000 acres of dry land in the Sacramento and San Joaquin valleys and will press for the passage of an appropriation during the next session of the legislature to carry on this work.

R. C. Starr, construction engineer with the San Joaquin Light & Power Corporation, announces his partnership in the new firm, Thebo & Starr, Engineers and Contractors, San Francisco. The San Joaquin Light & Power Corporation has given Mr. Starr the privilege of taking outside work while retaining his position with that company. It will thus be possible for Mr. Starr and Mr. Thebo to keep together the large organization which has been built up by them during their work on important construction projects in various parts of the West within the past ten years.

A. C. McMicken, sales manager of the Portland Railway, Light and Power Company, is taking an active part in the organization of the Northwest Electric Service League, which is passing through the organization stages and beginning to take definite form that will soon render it an active organization. Mr. McMicken began his electrical career in 1902, when he entered the employ of the Portland General Electric Co. After consolidation in 1906, resulting in the formation of the Portland Railway, Light & Power Company, he became



power and motor salesman. He held the position of contract agent from 1907 until 1912 when he was made sales manager, which position he now holds. Mr. McMicken has always taken a very active part in Association affairs in the Northwest and is at present a member of the Governing Committee of the Commercial Section of the Northwest Electric Light and Power Association.

J. A. Kahn, general manager of the Capital Electric Company of Salt Lake City, is chairman of the advisory committee of the Rock Mountain Electrical Cooperative League, recently organized. Mr. Kahn has been one of the leaders of the electrical industry in the Intermountain district. Since 1918 he has been connected with the Capital Electric Company, one of the largest firms of its kind in the West. Until recently he has been acting as vice-president and treasurer but has been made general manager. It is felt that Mr.



Kahn's long experience in executive capacities and his wide acquaintance in business circles will do a great deal toward making this new cooperative movement a big success.

Edward C. Connolly, of the Conlon Electric Washer Company of Cicero, Ill., is on a visit to San Francisco and other Pacific Coast cities.

V. H. Greisser, chief engineer, Washington Water Power Company, Spokane, Washington, is a recent San Francisco and Los Angeles visitor.

R. D. Likely, formerly electrical engineer with the General Electric Company, Schenectady, N. Y., is now in the electrical engineer's office of the San Joaquin Light & Power Corporation.

C. B. Merrell, who has for a number of years been in the general offices of the Economy Fuse & Manufacturing Company, has been appointed district sales manager of the Philadelphia office.

A. M. Frost, district agent at Selma for the San Joaquin Light & Power Corporation, has resigned to take up the sale of electrical equipment. After September the first he will be succeeded by J. H. Jarnagin of the Selma office.

A. C. Holden, sales manager, household appliances division, General Railway Signal Company of Rochester, New York, has been visiting San Francisco, incident to a trip throughout the states in the interests of his company.

O. B. Askren, general sales manager of the King Washing Machine Company of Wolcott, Indiana, is a recent Pacific Coast visitor and has spent some time in both San Francisco and Los Angeles attending to business matters.

F. M. Cooley, sales manager of the Seattle offices of the Western Electric Company, recently spent a week in the northern part of the state of Washington, looking after the affairs of his company. A major portion of the time was taken up in Bellingham.

H. W. Rogers and W. L. Merrill, paper mill experts of the Power and Mining Engineering Department of the General Electric Company at Schenectady, are in Portland supervising the starting of the new sectional drive paper machine, at the mill of the Crown Willamette Paper Company at West Linn, Oregon.

E. E. Garlits and R. B. Berry, of the merchandising bureau of the Westinghouse Electric & Manufacturing Company, are making a tour of the West in the interest of the merchandising bureau of their company. They arrived in San Francisco last week from Los Angeles and have now left for Seattle.

R. H. Ballard, vice-president, Southern California Edison Company, J. R. Baurhyte, chief electrical engineer of the Los Angeles Gas and Electric Company, E. B. Criddle, general agent, Southern Sierras Power Company, Riverside, S. M. Kennedy, general agent, Southern California Edison Company, G. D. Smith, general manager, Ontario Power Company, Ontario, A. B. West, president, Southern Sierras Power Com-

pany, and A. E. Wishon, assistant general manager of the San Joaquin Light & Power Corporation, were in San Francisco last week attending a meeting of the Public Relations Committee of the Pacific Coast Section of the N. E. L. A.

G. E. Armstrong, Pacific Coast editor of the Electrical World, has returned to San Francisco after a four months' visit at the New York offices of the McGraw-Hill Company. Mr. Armstrong returned over the Chicago, Milwaukee & St. Paul Railroad and visited members of the electrical industry in the Northwest.

Edward Whaley, for nineteen years in the employ of the Northern California Power Company, and later in charge of the Northern District of California for the Pacific Gas & Electric Company, has tendered his resignation to accept a position with the Baymiller-Post Company, large land owners throughout the state.

W. S. Berry, Pacific Coast sales manager of the Western Electric Company, San Francisco, has been elected chairman of the recently formed Committee on Power Companies Securities of the San Francisco Electrical Development League. Robert Sibley, editor, Journal of Electricity, has been elected secretary. Other members of the committee are: D. E. Harris, vice-president, Pacific States Electric Company; Garnett Young, general manager, Garnett Young & Company; R. A. Balzari, manager industrial division, Westinghouse Electric & Manufacturing Company; Clyde Chamblin, general manager, California Electrical Construction Company, and W. B. Sawyer, sales engineer, United States Steel Production Company.

Allen G. Jones, special solicitor of the General Electric Company, has been elected secretary of the San Francisco

Section of the American Institute of Electrical Engineers. Mr. Jones is a graduate of the Alabama Polytechnic Institute with the class of 1905 and after graduation worked for the Pensacola Electric Railway Terminal Company. In 1908 he joined the General Electric Company at Schenectady, working with Charles P. Steinmetz on high voltage apparatus and lightning arresters. In the next year Mr. Jones came to the

San Francisco office of the General Electric Company as specialist on high voltage apparatus and in 1915 was elected secretary of the San Francisco Section of the A. I. E. E. for the first time. Mr. Jones has held this position continuously since that time and the excellent manner in which he has filled this office in the past assures the Section success for the coming term.



OBITUARY

Wm. A. Cattell, formerly active in engineering affairs in and about San Francisco, and secretary of the International Engineering Congress in 1915, died recently at his home in Alhambra, California.

Chester A. Thomas, who has been in charge of the Guggenheim mining interests in Arizona and California for many years, died recently in Dawson. Before last August he was manager of the Selby Smelter in San Francisco.



Does your husband swear when the baby cries at night?

MAKE IT AN ELECTRICAL CHRISTMAS
WITH AN ELECTRIC MILK WARMER

HAPPENINGS IN THE INDUSTRY

POWER PROJECT PROPOSED IN OREGON

The development of 11,700 horsepower is contemplated in an application filed with the state engineer by the Clackamas Power & Irrigation Company, a subsidiary company of the Portland Railway Light & Power Company of Portland. The application contemplates the erection of a hydroelectric plant on the Clackamas river east of Oregon City and the appropriation of 1000 second-feet of water from the river. A flume 6.6 miles long will also be constructed, the estimated cost of the entire project being \$1,250,000.

Application for the appropriation of water and filing of plans for the plant are preliminary and immediate development is not contemplated.

SURVEY OF COLUMBIA BASIN PROMISED

A board of review has been named to examine the report of the State Columbia Basin Survey Commission on behalf of the Department of the Interior. It is expected that action will soon be taken by the Department. Two members of the board, as named by Arthur P. Davis, director of the United States Reclamation Survey, are D. C. Henny of Portland and James Munn, Denver, both consulting engineers of the survey.

SECURITY BOOKLETS



These readable looking pamphlets which deal with the financial problems of the electric light and power industry have been prepared by the publicity department and the executive committee of the Public Relations national section of the N. E. L. A. in cooperation with the Public Service Securities Committee of the Investment Bankers' Association of America. It is planned to have these forwarded by members to their security holders or prospective purchasers of securities. The Investment Bankers plan to circulate 200,000 to their own clients.

NEW POWER COMPANY IN ARIZONA

A new western power company was created November 15 when the Central Arizona Light and Power Company of Phoenix, Arizona, took over the property of the Pacific Gas & Electric Company of that city and commenced operations with a birthright of eight thousand consumers.

The new company plans to grow even faster than its predecessor, which itself has grown during the past few years even more than the city of Phoenix itself, because of the great demand for power for manufacturing and irrigation purposes. During the past year over one hundred thousand dollars have been spent to construct transmission lines and substations to serve the Avondale district with irrigation power. As a result of this development over seven thousand acres have been turned from desert to prosperous farm lands.

The management estimates that \$1,500,000 will be spent for improvements during the next three years.

BANKERS TO CO-OPERATE WITH PUBLIC UTILITIES

The board of governors of the Investment Bankers Association of America has passed a resolution of especial significance to all public utilities in this country. It states that whereas expanding public utilities are essential to the welfare of communities and the cost of operation has been considerably increased and there is a recognized shortage of power,

"Therefore Be It Resolved, That it is the sense of the Board of Governors of the Investment Bankers' Association of America that there should be cooperation between the investment bankers, and the owners and operators of public utilities, and the regulating officials, in laying before the public full information respecting the vital importance of prompt and continuing expansion of all kinds of utility service, and in encouraging such utility regulation as will provide sound credit as the basis for financing, to the end that the investing public may provide the necessary funds by investment in sound public utility securities."

PASADENA STARTS LIGHTING PLANT ADDITIONS

The first unit of a \$300,000 addition to the municipal lighting plant of Pasadena will be installed next summer, according to C. W. Koerner, general manager of the plant. The light department has just purchased several lots from the Pacific Electric Company and a new building is to be erected to house the enlarged plant.

One boiler is to be installed during the coming summer at a cost of \$50,000, while a turbine and two other boilers will be put in the following summer.

GREAT WESTERN POWER COMPANY HEARING

That the Great Western Power Corporation expects to spend \$200,000,000 upon its California hydroelectric development program within the next fifteen years, and that the Railroad Commission will not accept the present high prices in arriving at a rate base, were the features of the initial hearing of the Great Western Power Corporation's recent application for increased rates. The hearing was continued until January 19, 1921.

P. G. & E. RATE HEARING IS POSTPONED UNTIL JANUARY 17

The hearing in the case of the Pacific Gas & Electric Company for readjustment of electric power rates will begin January 17, 1921, in the commissioner's room in the Flood Building, according to an agreement reached between consumers, attorneys and individuals, and corporations and the State Railroad Commission. The continuance was granted by Commissioner Frank R. Devlin to allow the engineers interested in the case to study valuations of the properties involved.

SURVEY OF WASATCH RANGE COMPLETED

The topographic survey, which was begun last July, covering the entire western slope of the Wasatch mountain range, has been completed.

The work of assembling the maps and making plats will be done at the headquarters of the U. S. Geological Survey at San Francisco and as soon as possible copies of the maps will be issued by the Government in the form of a bulletin which will be furnished to all applicants.

The data gained will also be used by Ralf R. Woolley, hydraulic engineer of the U. S. Geological Survey, at Salt Lake City, in compiling his book on "Water Power Possibilities of the Great Salt Lake Basin."

INITIAL STEP IN POSSIBLE 10,000 HORSEPOWER DEVELOPMENT

The Peninsula Light and Power Company, a newly organized company of which James Murray is vice-president and treasurer, is developing a project on the Skykomish river four and a half miles west of Potlatch, near Lake Cushman. The initial development will be 10,000 hp. and the claim is made that a development of 350,000 hp. is possible at this point. The company has entered into a contract with the Northwest Electric & Water Works Company to supply them with electric energy June 1, and negotiations are under way with the lighting companies of Hoquiam and Aberdeen to supply them with power.

ELECTRICALLY OPERATED OLIVE PLANT



The opening of this new electrically operated olive plant of the Ehmann Olive Company was a feature of the fifth Orange and Olive Exposition held in Oroville, California, during the latter part of November. It is estimated that this electrically operated plant with a load of 100 hp. will turn out 12,000 cans of olives and 60,000 gallons of olive oil this season.

REHEARINGS OF CONTRACT CASE DENIED

The public utilities commission of Utah has denied the petitions of thirty-three of the larger customers of the Utah Power & Light Company for rehearings in the "special contract" case which was recently decided by the commission and reported in the November 15th issue of the Journal of Electricity. This denial leaves the way open in regular procedure for appeal to the supreme court of the state, or, in course of time, to the Supreme Court of the United States.

In this decision the commission granted the Progress Company, the Salt Lake Pressed Brick Company, and several other customers, permission to re-open their cases and make additional showing to the effect that certain water rights transferred to the power company had an actual value justifying the low rates given in the special contracts. The two customers above named have re-opened their cases. In these instances water rights for power purposes in Mill Creek and the Cottonwood canyons are involved.

THE SAFETY FIRST LESSON

Every announcement in the morning newspapers of a death through electrocution is a setback to the public confidence in all use of electricity,



Carelessness proves fatal

as well, of course, as an irreparable personal and economic loss and nothing should be left undone to impress the dangers of carelessness upon employees. The lesson of safety first is well told by this remarkable snapshot of an accident which occurred in Portland, Oregon. The line-man who suffered the fatal accident had disregarded instructions in not using shields and rubber gloves, with this result. The gloves may be seen on the top cross arm to the right of the pole.

PIT RIVER DEVELOPMENT STARTED

The initial step in the development of some 80,000 horsepower along the Pit River was taken on November 6 when the Pit River Power Company awarded Palmer & Peterson, of San Francisco, the contract for constructing the 200-ft. dam at Sheep Rocks.

The entire project contemplates the development of potential water power along the Pit River, Shasta county, California, from Mile 12 above the junction of the Sacramento River to Mile 34. Within this distance there is a fall of approximately 400 feet, and it is proposed to utilize this by constructing two dams approximately 200 feet high across the river canyon. The normal minimum stream flow is 2,700 second-feet. Sheep Rocks, the site of the first plant, is about two miles above the junction of the Pit with Squaw Creek; fifteen miles northeast of Redding. A railroad two miles in length will be built from the Sacramento Valley & Eastern Railroad to the damsite. This initial plant will be for 48,000 kw., or approximately one-half the total. Vertical wheels of the Francis type are to be used, operating under an effective head of 190 ft. Generators will each be 16,000-kw., 3-phase, 60-cycle, and the voltage will be stepped up in outdoor type transformer stations to a transmission voltage to be determined later.

ELECTRICAL EXHIBIT AT TULARE COUNTY FAIR

One of the notable features of the Tulare county fair held at Visalia, October 9th to 16th, was the combination electrical exhibit of the Chaffee Electric Shop, Visalia, and the E. M. M. Service, Lindsay and Exeter. These two companies occupied a double space corner location booth.

The Chaffee Electric Shop devoted space to the exhibition of electric appliances, washing and ironing machines and electric ranges. The E. M. M. Service featured the ISKO electric refrigerator.

Each visitor was required to sign a ticket which entitled him to take part in a prize drawing for a Westinghouse Cozy Glow heater. Over seventy-five thousand visitors registered and took part in this drawing.



During the Tulare county fair electric range demonstrations were conducted here daily by Mrs. Eugenia Galvin of the Westinghouse Electric & Manufacturing Company, and ironing machines were demonstrated by Mrs. E. Scott. Mr. Harry Nutt, E. M. M. Service, was in attendance daily, demonstrating the ISKO electric refrigerator.

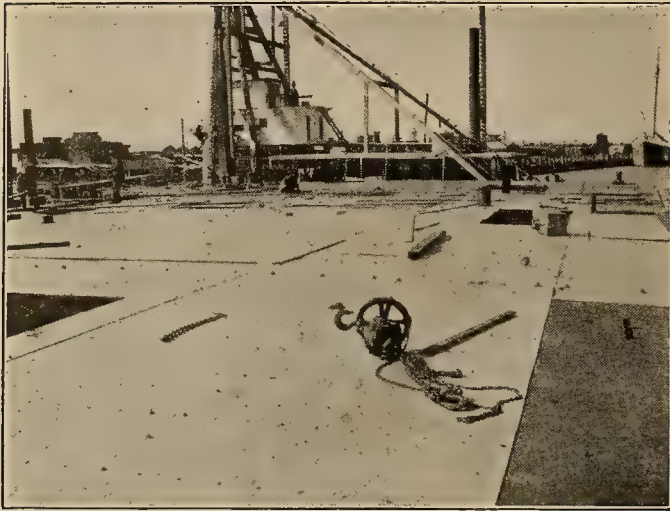


Does the spectre of the high cost of gasoline haunt your dreams?

MAKE IT AN ELECTRICAL CHRISTMAS WITH AN ELECTRIC AUTOMOBILE

CLAM SHELL DREDGE IS BEING ELECTRICALLY WELDED

Electric welding is being used extensively in the construction of a large steel clam shell dredger now being built at the shipyard of B. P. Lanteri at Pittsburg, California, for



One man is able to weld forty feet of this steel deck every day with a regular electric welding outfit

the Monarch Dredging Company. This vessel will be used in reclamation work in the lower delta regions of the Sacramento and San Joaquin rivers.

The principal welding is being done on the steel deck. These $\frac{1}{4}$ -inch plates are being lap welded with a 200-ampere, 60-volt G. E. welding outfit. The generator is being driven with a belt-connected 10-hp. motor. One man is doing the welding and is able to cover about 40 feet a day.

In addition to welding for the deck the machine is being used for such other work as sealing up joints instead of caulking, going around edges of outboard fittings to make them watertight, as well as assist in securing the same, attaching hangers and brackets for pipes, fittings and machinery, in the construction of tanks and various other kinds of work.

After the dredge is completed the electric welding set will be part of the equipment of a well appointed machine shop aboard the dredge for use in repair work.

SAN FRANCISCO LIGHTING EXHIBIT OPENS

The Industrial and Commercial Lighting Exhibit of the California Electrical Cooperative Campaign in the Safety Museum of the State Industrial Accident Commission in San Francisco was opened on the evening of November 22. Members of the State Industrial Accident Commission and of the San Francisco Electrical League were the especially invited guests at the opening demonstration.

Mr. D. E. Harris of the Advisory Committee of the Cooperative Campaign acted as chairman of the evening, and in his remarks regarding the object of the exhibit laid emphasis upon the fact that this is not an exhibit of materials or lighting units, but an exhibit to demonstrate and visualize the benefits of correct and efficient industrial and commercial lighting as contrasted with incorrect and inefficient lighting installations. He urged that the electrical men present remember that the primary purpose of this exhibit is to sell the service of better industrial and commercial lighting to the public and that the Advisory Committee would not tolerate any subversion of this primary object to the commercializing of the exhibit by any manufacturer or his representative whose material or lighting units are installed in the exhibit. He stated that if the exhibit should be commercialized by the people handling any of this material the Advisory Committee would promptly remove their material from the exhibit.

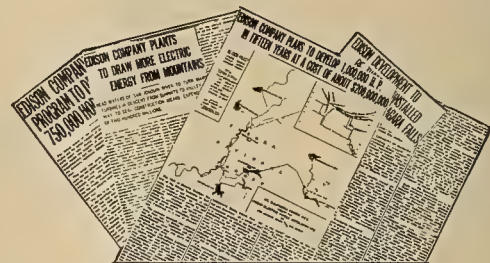
W. J. French, chairman of the State Industrial Accident Commission, was introduced and on behalf of the Commission welcomed the men of the electrical industry and invited their cooperation with the Commission in the solution of the various problems affecting safety in industrial plants.

L. E. Voyer, president of the San Francisco Chapter of the Illuminating Engineering Society, was then introduced to present the subject of better industrial and commercial lighting. The subject was presented with the aid of actual demonstrations of the effect of various systems of lighting which are made possible with the installations provided for this exhibit. Five separate types of lighting installations are installed and by means of a central switchboard and an arrangement of cords and pulleys the various installations can be operated separately or simultaneously and the effect of height and spacing of units observed.

On November 27th this lecture and demonstration was repeated under the direction of Clark Baker for the benefit of the electrical contractors and dealers. Robert Prussia will direct the December 3rd demonstration which will be held for the benefit of the central station men, jobbers' salesmen, architects and engineers of the region surrounding San Francisco. An effort is being made to have men as far south as San Jose present at this time.

The California Electrical Cooperative Campaign is now installing a similar exhibit in the rooms of the Chamber of Commerce, Los Angeles. The month of January, 1921, will be devoted by the Campaign to the subject of industrial and commercial lighting and every member of the industry should be prepared to help sell this idea to the public.

NEWSPAPERS TELL THE STORY



The Southern California Edison Company recently took the newspaper men of southern California over its system, telling them the same story of future development which was presented in the May 15th issue of the Journal of Electricity. Some of the valuable results are shown above. Without a doubt the story has been told to the public. From left to right the above clippings appeared in the Courier of Oxnard; Facts of Redlands; Delta of Visalia, and the Hanford Sentinel, Hanford.

CALIFORNIA RAILROAD COMMISSION ISSUES ANNUAL REPORT TO GOVERNOR

Declaring that California is at the gateway of enormous possibilities but that it will not reach the peak of development unless its wonderful natural resources are carefully fostered and utilized, the California State Railroad Commission, in a letter to Gov. William D. Stephens transmitting its annual report, urges a survey of the state's water and power resources. Full use of water and cheap power are the state's need, says the Commission.

"California's streams and rivers, its rainfall and its snowfall must be made to serve and to serve well. It is the Commission's firm belief that financially sound utilities, functioning economically and efficiently will successfully carry the burden of California's development. It is obvious that industrial California, agricultural California cannot reach the peak of development unless there stride, a step in advance, utilities carrying service possibilities 'ready on demand.' Such a service has been, is and will be the aim of this Commission. It can be accomplished only through the fair distribution of the costs and fair treatment of utility consumer, utility owner and utility labor."

Continuing, the report covers water conditions, utility costs, fuel costs, the Federal Transportation Act, electric railway conditions and auto transportation.

ELECTRICAL UTILITIES AND THE LEVER ACT

In view of the widespread publicity given the indictment of the Brooklyn Edison Company, Inc., for alleged violation of the Lever Act, executives of electric light and power companies will be interested in the decision of Judge Julius M. Mayer of the U. S. District Court of New York, to the effect that hoarding coal by public utilities corporations is not punishable under the provisions of the Lever Act because "the defendant is not a wholesaler, retailer or other dealer in coal, nor is it a manufacturer within the meaning of Section 6. * * * The defendant is a public utilities corporation engaged in the business of the manufacture, production and sale of electric light and power. * * * They owe a duty to the community to furnish light and power adequately and without cessation so far as practicable. * * * It was the duty of the light and power public utility corporation, so far as possible, to safeguard against the shutting down or suspension of service of light and power."

SALES CAMPAIGNS SUCCESSFUL

Jobbers and dealers in the Puget Sound district, especially those in the smaller towns and rural communities, are conducting sales campaigns on electrical appliances with fair results. Reports from several different sections in this district state washing machines, vacuum cleaners and socket device heaters are moving very satisfactorily. Ironing machines, also, while comparatively new in this territory, are showing a good movement considering their price.

In most cases, the campaigns consist of window demonstrations, house to house solicitations and newspaper advertising.

HYDRO-ELECTRIC PLANT TO BE CONSTRUCTED IN ARIZONA

One of the largest hydroelectric and irrigation projects in the Southwest is soon to be undertaken near Planet, Ariz., by the Stone Consolidated Copper Company, as shown by surveys which it has just filed with the state authorities. It is planned to construct a dam across the Big Williams fork of the Colorado river at a point near Planet and to impound a sufficient supply of water to irrigate 276,000 acres of desert land. The storage supply of water will be used for generating electric power for operating the mines and industries of a big scope of territory.

CALIFORNIA PUBLIC UTILITIES TOTAL 798

There are 798 public utilities in California filing annual statements with the Railroad Commission, says the annual report of the Commission for the year ending June 30, 1920, just made to the Governor. Of these 19 filed their first report at the close of 1919, and in the same period 40 filed their last report. The reports filed with the Commission cover the finances of the utilities. They are made in accordance with a form prescribed by the Commission, which also prescribes the accounting methods of the utilities. The following shows the number and class of utilities operating in this state:

Steam railroads—operative	50
Steam railroads—lessor	9
Steam railroads—under construction	3
Electric railways—operative	30
Electric railways—lessor	4
Electric railways—under construction	2
Express companies	25
Water carriers	70
Electric companies	21
Gas companies	13
Gas and electric companies	106
Telephone companies	3
Telegraph companies	7
Telephone and Telegraph companies	142
Warehouse	299
Water companies	14
Wharfingers	

Total.....798

RIGHT TO PROHIBIT WATER APPLICATION QUESTIONED

Constitutionality of the Utah state law, giving the state engineer power to withdraw from entry, with the consent of the governor, the waters of any particular river or other source of supply, is to be tested out in a suit brought by Caleb Tanner against the present state engineer, George F. McGonagle.

Mr. Tanner has filed application with the state engineer for permission to divert 33.47 second-feet of water from the Provo river, with which to develop about 250 horsepower of electrical energy, and to return the water to the West Union canal. Mr. McGonagle refused to accept the application, apparently on the ground that the waters of the Provo river have been withdrawn from entry for the present. This action was taken on the organization of the Utah Water Storage Association, an organization of eight counties watered by the Provo and Weber rivers and by waters from Utah lake. The association requested the withdrawal of the two rivers and of Utah lake waters during the period of investigation of possibilities of development, and the state engineer acted under a law passed two years before.

LARGEST RADIO STATION ON COAST PROPOSED FOR SEATTLE

A proposal to give Seattle the most powerful radio telegraph station on the Pacific Coast, providing shippers with a service which will enable them to reach vessels as far out as 2,500 miles at sea, was placed before the Finance Committee of the City Council by the Independent Wireless Company of America recently.

MILWAUKEE ROAD SHOWS VALUE OF ELECTRIFICATION

Electrification on the Milwaukee-Chicago & St. Paul Railroad has fulfilled all expectations and the continued tests and comparisons with the steam locomotives are all in favor of the electric motive power, according to H. B. Earling, vice president of the Milwaukee railroad.

"To relieve freight congestion we have managed to increase freight mileage per hour and to get larger loads on cars. We have expected a greater demand for cars than the supply, but at the present time the car shortage has practically ceased."

ELECTRICITY TO BE USED IN LARGE DREDGING PROJECT

Electrically operated dredges are to be used entirely by the largest dredging project ever scheduled on the Pacific Coast, which will be done as a part of the \$3,000,000 dredging, reclamation and construction work scheduled by the naval public works department in the San Diego harbor.

The contract for about 3,300,000 cubic yds. has been let to the United Dredging Company of Los Angeles. For a time the company is planning to operate one electric dredge with from 100 to 1200 hp. taken from the shore. As soon as the work now being done for the War Department is finished, the dredge being used there will be moved to the Navy project. This dredge, which is the most powerful on the Pacific Coast, has a capacity of from 1200 to 1400 hp. and having a steam turbine can either generate its own current or take it from the shore.



Do you burn your fingers with a match when you drop your change in the dark?

MAKE IT AN ELECTRICAL CHRISTMAS WITH AN ELECTRIC FLASHLIGHT

INCREASED YIELD FROM PUBLIC UTILITY SECURITIES

A recent statement issued by the National City Company, New York City, shows that utility securities yield two and three per cent more now than before the war. It reads as follows:

"Discriminating investors are now analyzing the public utility situation. New capital is required in every branch of the public utility field, and this company seeks to bring to the attention of investors securities which have been purchased after careful investigation and which, in our judgment, justify high confidence. Before the war public utility securities issued by corporations of undoubted strength and based on strong values and earning power were sold on a basis to yield around 5 to 5½ per cent. Now, with largely increased values and increased demand for the output, the same class of securities can be bought on a basis to yield from 7 to 8 per cent."

GROSS EARNINGS OF P. G. & E. SHOW \$6,414,535 GAIN IN NINE MONTHS

The Pacific Gas & Electric Company has made a public statement to the effect that its gross earnings for the first nine months of 1920 showed an increase of \$6,414,535 over the corresponding period of 1919.

According to the company this remarkable increase in earning capacity was due partly to the acquisition of new territory and in part to a more intensive cultivation of the field already covered by the company's operations.

The balance remaining for preferred stock dividends, after providing for operating expenses, fixed charges and every foreseeable contingency, was \$3,083,138.87. The three quarterly preferred stock dividends so far paid this year aggregate \$1,317,797.38, leaving a margin of safety over these dividends of \$1,765,341.49.

In other words, the company earned its preferred stock dividends in this period 2.34 times.

Approximate condensed income account statement for the nine months ended September 30, 1920, together with comparisons, follow:

	1920	1919
Gross earnings, incl. miscellaneous income....	\$25,879,471.61	\$19,464,936.58
Maintenance and reserve for depreciation.....	3,112,370.60	2,293,800.11
Operating expenses, rentals, taxes (including Federal taxes) and reserves for casualties and uncollectible accounts.....	15,072,938.34	10,433,441.25
Total expenses	\$18,185,308.94	\$12,727,241.36
Net income	7,694,162.67	6,737,695.22
Bond and other interest.....	3,644,680.20	3,154,313.57
Balance	\$ 4,049,482.47	\$ 3,583,381.65
Bond discount and expenses.....	216,343.60	155,942.04
Balance	\$ 3,833,138.87	\$ 3,428,439.61
Additional depreciation reserve.....	750,000.00	750,000.00
Surplus	\$ 3,083,138.87	\$ 2,677,439.61
Dividends on preferred stock.....	1,317,797.38	1,127,089.28
Balance	\$ 1,765,341.49	\$ 1,550,350.33

NEW LAW WILL AID ROAD BOND SALES

At the November 2nd election California voters approved a measure whereby there is provided a flexible rate on highway bonds and means for adjusting that rate from time to time to suit market conditions. This measure is expected to very materially expedite financing state highway work, to more equitably distribute its cost, and to relieve the highway commission of the necessity for requiring counties to contribute the difference between the par and market values of bonds used for road work within their boundaries.

It will probably be February first before all arrangements are made so that contracts can be let safely.

CITY AND UTILITIES TO COOPERATE UNDER NEW LAW

Amendment thirty to the San Francisco charter passed November 2nd, provides a simple method whereby city officials can agree with utility officials on price and terms and then submit to popular vote for ratification any proposal for purchase of a utility. Only a majority vote is required to carry.

TRADE NOTES

Electric Appliance Factory in Chicago —

A one-story factory to be used for the manufacture of an electric appliance known as the Mercer Ironing Machine is to be constructed by the Western Appliance Manufacturing Company of Chicago. C. N. Briggs is president of the company, and P. H. Vanasse, vice-president; B. N. Mercer is secretary. The plant is to have a capacity of five hundred machines within ninety days, it is stated by company officials. The structure will be 110 ft. by 90 ft. in size and will cost \$25,000, exclusive of equipment.

90% of Employees Take Voluntary Insurance —

Over 90 per cent of the employees of the Westinghouse Electric & Manufacturing Company, at the East Pittsburgh Works, have taken advantage of the additional insurance feature of the Insurance and Savings Plan recently made effective by the company.

New Electric Shop in Alhambra —

R. E. Heerman, organizer of the S. & H. Service Electric Co., Inc., El Monte, California, is now in Alhambra, California, giving personal attention to their store No. 2 which was opened a short time ago in that city.

New Portland Store —

The former J. R. Davidson Electric Co. of Portland has been changed to the Davidson-Atwood Electric Co., and is now located at 390 Morrison Street. L. E. Atwood, formerly with the Stubbs Electric Co. and the North Coast Electric Co., both of Portland, has bought a half interest in the firm.

Intermountain Representative —

The Roller-Smith Company, New York, announces the appointment of Mr. L. Brandenburger, 59 West Broadway, Salt Lake City, as its representative in Utah and parts of Idaho, Wyoming and Montana. Mr. Brandenburger will handle the Roller-Smith Company's entire list of instruments, meters and circuit breakers in that territory. In addition he represents the Wagner Electric Manufacturing Company, the Cutler-Hammer Manufacturing Company, the Delta Star Electric Company, the American Insulated Wire & Cable Company and the Esterline Company.

Salt Lake Company Opens New Home —

The Capital Electric Company of Salt Lake City has recently opened the doors of its new home, which has four spacious floors and large basement, affording 42,000 square feet of space, to be used for warehouse, showroom and office purposes.

E. M. Ellis, a General Electric Company warehouse specialist, spent several months supervising the work of architects and builders. Among the distinctive features of the building are an unusually attractive display room, an automatic passenger elevator, a large spiral gravity chute, a machine shop and factory, and the most modern provision for the comfort of employees.

Wagner's Service Station in Portland —

The Wagner Electric Company will open up a service station at 327 Flanders street, Portland, Ore., for service on motors and other equipment sold by them. The company has also announced the removal of its Salt Lake City office to 59 West Broadway and the opening of a service station as well at this address. L. Brandenburger will continue in charge as branch manager.

New Seattle Store —

The Riley-Conley Company recently opened an electrical retail store in Seattle, handling a complete line of electrical appliances for the home. This company is western Washington distributor of Western Electric power and lighting outfits, appliances and apparatus.

Meeting Notices for Electrical Men

(The newly organized Rocky Mountain Cooperative League, the Jobbers' camping trip, the 1921 plans which the Advisory Committee has made for the California Cooperative Campaign, and numerous A. I. E. E. activities in all parts of the West are among the meeting notices presented on the following pages. The recent Advertising meeting of the San Francisco Electrical Development League is also presented as well as a report of the new members of the Federated American Engineering Societies.—The Editor.)

Plans for 1921 Made at Advisory Committee Meeting

The Advisory Committee of the California Electrical Cooperative Campaign held its monthly meeting in Los Angeles on the 15th and 16th of November, at which time the plans on the work of the Cooperative Campaign during 1921 were discussed and the necessary action taken to put them into operation. One important feature of these plans is the decision to devote each month of the coming year to a particular problem of the electrical industry in California by concentrating the work of the organization each month upon one particular subject.

At luncheon on the first day of the meeting a considerable number of representatives of the different branches of the industry were guests of the Advisory Committee and a discussion of different phases of the Cooperative Campaign's work took place. Mr. E. E. Garlits brought a message of congratulation and a promise of cooperation from the Pittsburgh offices of the Westinghouse Company and said that the entire electrical industry in the East is much interested in the work of the Campaign. Mr. R. H. Ballard, of the Southern California Edison Company, said that one of the most valuable achievements of the Cooperative Campaign is the development of a spirit of confidence among the different branches of the electrical industry in California which will make possible even greater accomplishments by the Cooperative Campaign during the coming years.

The Advisory Committee visited the Modern Electrical Home now open in Los Angeles, and was delighted to note the interest shown by the public, and the effective cooperation of the electrical industry in preparing the exhibit. The Advisory Committee will continue the work of establishing electrical homes throughout the state during 1921 and expects to achieve large results in better and more adequate wiring of homes, to the mutual benefit of the public and the electrical industry.

L. B. Fuller and J. B. Ambler were appointed on the committee for drawing up a law for licensing engineers. The chairman announced that an extension to the section's territory had been granted.

Northwest Development at Joint Oregon Meeting

The development of the Northwest was the subject of an address given by G. E. Armstrong, Pacific Coast Editor of Electrical World, at the November 23rd meeting of the Portland Sections A. I. E. E., the N. E. L. A. and the Association of Electrical Contractors and Dealers.

Early Electrical Experiences and Inductive Interference Topics at Utah A. I. E. E. Meeting

At the November 10th meeting of the Utah section of the American Institute of Electrical Engineers E. G. Holding presented an interesting paper under the title, "Early Electrical Experiences in Utah," which called forth the suggestion that an early history of the electrical industry in Utah be obtained and made part of the Institute records while a few pioneers are left. A very instructive paper under the title of "Inductive Interference Problems" was presented by P. A. Jeanne.

Industries Association Holds "Furniture Day" Meeting

The importance of building up western industries was emphasized at the November 18th meeting of the California Industries' Association, which was given the name of "Furniture Day." The most significant fact brought out in the talks of leaders of the furniture industry was that the campaign to educate Californians to the value of purchasing California goods has borne fruit, and one instance is the fact that in ten years the amount of California-made furniture purchased from California stores has increased from practically nothing to fifteen per cent of the total sales.

Mining Men Entertained by Denver A. I. E. E.

The members of the Mining Congress which convened in Denver during the week November 15-20 were guests of the Denver Section

A. I. E. E. at the November 20th meeting. Mr. H. F. Lunt, Commissioner of Mines for the state of Colorado, addressed the meeting on Electricity in Mining from a Standpoint of Safety.

Rocky Mountain Cooperative League Is Organized

For the purpose of conducting an educational campaign to encourage cooperation between the several branches of the electrical industry, to further the practice of good ethical business methods and to give the consumer better value for the money he spends for electrical service, the Rocky Moun-

BUILDERS OF THE WEST—XC



ROBERT M. KEENEY

The discovery of gold and other precious metals was one of the original causes of the settlement of the West, and while an industrial and agricultural center has been built up by the sons of those gold-seeking pioneers, the production of metals still makes a great contribution to the wealth of the West. The mineral resources and abundant water power west of the Rockies should make this section an important center for the electric furnace industry and the fresh source of wealth it is developing in the production of the ferrous alloys of tungsten, vanadium and manganese. To Robert M. Keeney, director of the Department of Metallurgical Research of the Colorado School of Mines, this issue of the Journal of Electricity is affectionately dedicated in appreciation of the important work which he has done in making possible the extended use of the electric furnace in this field.



Does the small boy of the house borrow the wire clothes line for antennae?

MAKE IT AN ELECTRICAL CHRISTMAS WITH A RADIO SET

tain Electrical Cooperative League has been organized at Salt Lake City, Utah.

The activities of the League will extend to the states of Utah and Idaho; also that portion of Wyoming and Nevada served by Salt Lake City as a distributing center for electrical goods.

An advisory committee, which will be the governing body, has been appointed, consisting of representatives of



B. E. Rowley, to the left, is vice-president of this new cooperative league. He holds the position of sales manager with the Edison Electric Appliance Company. R. M. Bleak, secretary and treasurer of the advisory committee, is superintendent of lighting and appliance sales for the Utah Power & Light Company.

the manufacturer, the jobber, the contractor-dealer and the central station, the four branches of the electrical industry. This committee is composed of the following men:

J. A. Kahn, vice-president and general manager, Capital Electric Co., chairman.
S. R. Inch, vice-president and general manager, Utah Power & Light Co.
F. M. Parry, commercial manager, Utah Power & Light Co.
R. M. Bleak, superintendent lighting and appliances sales, Utah Power & Light Co., secretary and treasurer.
H. M. Ferguson, manager Salt Lake Division, Utah Power & Light Co.
B. E. Rowley, sales manager, Edison Electric Appliance Co., vice-chairman.
C. H. Talmage, manager, Western Electric Co.
C. C. Campbell, sales manager, Intermountain Electric Co.
E. H. Eardley, manager Eardley Electric Co.
J. D. Nicholson, manager electric department, Mine & Smelter Supply Co.
Geo. R. Randall, manager, Salt Lake Electric Supply Co.
James S. Walker, manager, Walker Electric Supply Co.
G. W. Forsberg, manager, Wasatch Electric Co.
Stanley Stevens, manager, Stevens Sales Co.
Robert Miller, sales department, General Electric Co.
W. A. Moser, manager, Westinghouse Electric & Manufacturing Co.

The campaign will be conducted along somewhat similar lines to that of the California Cooperative Campaign.

San Francisco Section A. I. E. E. Hold First Meeting of Season

The San Francisco chapter of the American Institute of Electrical Engineers held the first meeting of the present season at the Engineers' Club in San Francisco on the evening of October 29. J. P. Jollyman, engineer of the Pacific Gas & Electric Company, newly elected chairman of the section, presided and introduced Miss Clotilde Grunsky, associate editor of the Journal of Electricity, as the first lady member of the Institute west of the Rocky Mountains.

R. C. Starr, construction engineer of the San Joaquin Light and Power Corporation, was the first speaker of the evening, and he told of the construction of the Kerckhoff project which set a record in speed. The talk was accompanied by a number of slides showing the project in various stages of construction and some of the methods used which made possible the great saving of time in the completion of the project.

L. J. Moore, electrical engineer of the San Joaquin Light and Power Corporation, then told of the construction of a 110,000-volt wood pole transmission line which was built by the company, and dwelt on the economic factors which governed the choice of this type of construction. One of the chief factors which led to the choice of this type of pole line was the fact that most of the line ran through highly cultivated country and the cost of rights of way for steel towers would have been prohibitive. Therefore it was decided to run the line on wood poles along the highways and Mr.

COMING CONVENTIONS

A. S. M. E. ANNUAL MEETING

New York City, Dec. 7-10, 1920

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS

Annual Convention—Salt Lake City, Utah
June 20-26, 1921

Moore's paper discussed the technical problems that had to be met in the designing of this line.

New Officers, Oregon Chapter A. I. E. E.

O. Laurgaard, city engineer of the city of Portland, was elected president of the Oregon chapter of the American Association of Engineers, at a recent meeting of the association. Other officers elected were three vice-presidents, a secretary and a treasurer. Lewis A. McArthur, secretary of the Oregon Geographic Board, spoke on "Topographic Surveys in Oregon." Percy Cupper, state engineer, said that without good topographic maps splendid reclamation possibilities might have been overlooked for many years.

The objects, purposes and aims of the association are stated as follows:

To distribute fullest information obtainable at all times regarding matter of excellent class of electric contracting and construction; to issue engineer data sheet regarding electrical engineering and contracting problems of more complex nature; to collect and distribute data pertaining to cost of operating and maintaining of an electrical contractor and retail establishment; to aid in bringing friendly relations between electrical contractors and dealers and others engaged in electrical industry; to assist in marketing only high grade materials and apparatus of American manufacturing; to encourage members in conducting attractive electrical stores and promoting the welfare and interest of the employees. To elevate the standard of electrical installations and discourage the tolerance of electrical work by amateurs; to cooperate with the state board of fire underwriters and the state and municipal inspection department, municipal electric light and power company; to cooperate with and assist architects and engineers in successfully combating their various problems; to cooperate with local credit associations toward general improvement of local business conditions.

Legal Aspect of Merchandising Presented to Development League

"The Legal Aspect of Merchandising" was the subject of the talk presented to the San Francisco Electrical Development League at their regular meeting in the Palace Hotel on November 15. President Bill Shreve was back after his trip through the East and was accorded a hearty welcome by the members of the League. The committee on helping the public utilities to cooperate with J. E. Harris and W. E. Berry of the Jobbers' Association was announced as follows:

R. A. Balzari, manager industrial division, Westinghouse Electric & Manufacturing Company; C. H. Chamblin, manager, California Electrical Construction Company; Garnett Young, general manager, Garnett Young & Co.; W. B. Sawyer, Jr., sales engineer, U. S. Steel Products Co.; and Robert Sibley, editor, Journal of Electricity.

Mr. Albert Elliot, San Francisco attorney, the speaker of the day, made the distinction between intra-state and inter-state trading and stated that the Sherman Act, the Clayton Act and the Federal Trade Commission's decisions did not apply in the case of intra-state dealings. He also stated that the question of what determines intra-state operations had never been clearly settled.



This is the engineering committee of the Pacific Coast Section N. E. L. A. which so thoroughly discussed high voltage transmission and inductive interference at its recent Los Angeles meeting, as reported in the November 15th issue of the Journal of Electricity.

Camping on the McKenzie



SHOOTING THE JUDGE

This squad of braves were delegated to shoot the Judge Advocate, C. E. Wiggin, who seems to have issued a decree displeasing to the body at large.



THE CABIN

This log cabin located at the head of the McKenzie river, about sixty miles from Eugene, Oregon, was made the headquarters of the camping trip pictured on this page.



THE HOSTS

O. B. Stubbs and F. N. Averill, shown stumping it above, were the hosts at the Stubbs cabin. "Not a dull moment" was their motto, and according to reports they were successful.

Now that the good old summer time is at the opposite side of the calendar it is well to look back upon the summer frolics of the electrical industry. Famous among those which took place last August is the camping trip taken by a number of prominent jobbers of California and Oregon way up at the head of the McKenzie river. Judging from the after-smiles these two weeks accomplished the work of a whole line of cooperative campaigns.



DINNER

The entire party of campers can be seen here assembled around the board. At the extreme left one sees the arm and knee of C. R. Bach, Manhattan Electric Supply Co., S. F. Next is W. M. Deming, at that time with the McGraw-Hill Publishing Co., now in Tennessee. At Bill's left is C. M. Will, Fobes Supply Co., Portland. Then sits C. E. Wiggin, of Dunham, Carrigan & Hayden, S. F., then C. C. Hillis, Electric Appliance Co., S. F.;

F. N. Averill, Fobes Supply Co., Portland; O. B. Stubbs, Stubbs Electric Co., Portland; H. E. Sanderson, Bryant Electric Co., S. F.; H. B. Squires, S. B. Squires Co., S. F.; W. S. Berry, Western Electric Co., S. F., and back up to the front of the picture again, R. F. Oakes, of the National Carbon Co., S. F. S. W. Peterson of the Stubbs Electric Co. was there for dinner all right, but just doesn't happen to be in the picture.



THE START

The Northerners met the San Franciscans at Eugene and motors were taken from here to Squaw Camp. From left to right they are as follows: W. S. Berry, C. M. Will, R. F. Oakes, H. E. Sanderson, C. R. Bach, C. C. Hillis, Rudy Prayle and C. E. Wiggin.



OFF FOR THE WILDS

There is a story of a fishing and hunting trip which turned out a real roughing-it party with over a twenty-four hour scarcity of food. From left to right the mountaineers are: Bill Deming, C. R. Bach, R. F. Oakes and the guide.

New Members of Federated Engineering Societies Announced

The Joint Conference Committee of the A. S. C. E., A. I. of Mining and Metallurgical Engineers, the A. S. M. E. and the A. I. E. E. announce members to the Federated American Engineering Societies, as follows:

American Institute of Chemical Engineers, American Institute of Mining and Metallurgical Engineers, American Society of Agricultural Engineers and the Society of Industrial Engineers, as well as the Alabama Technical Association, Detroit Engineering Society, Engineering Association of Nashville, Engineering Society of Buffalo, Florida Engineering Society, Kansas Engineering Society, Technical Club of Dallas, The Cleveland Engineering Society and the Engineering Society of York.

Also the Grand Rapids, Kansas and Louisiana Engineering Societies, the Mohawk Valley Engineers' Club, Washington Society of Engineers and the Associated Engineers of St. Louis. The Iowa and the Florida Engineering Societies are to be ratified at the coming annual meeting.



Does it take six days for the newly painted floor to dry?

MAKE IT AN ELECTRICAL CHRISTMAS WITH AN ELECTRIC FAN

Executive Committee, N. E. L. & P. Association

The Executive Committee of the Northwest Electric Light and Power Association met in Portland, October 14, and carefully considered the report of the Advisory Committee presented at the Spokane Convention, and further details concerning the formation and objects of the Northwest Electric League were presented by members of the Advisory Committee.

It was the unanimous opinion of the Executive Committee that the Northwest Electric Service League can be the medium for closer cooperation of all branches of the electrical industry in the Northwest and that such cooperation will result in better service to the public, greatly increased use of electricity and electrical equipment, and the adoption by all elements of the industry of sound, ethical and progressive business methods.

Congratulations to the A. S. M. E.

The following telegrams of congratulation which were received by W. W. Hanscom, president of the San Francisco Section A. S. M. E., at the recent fortieth anniversary celebration, show that the leaders of this country realize that the engineer is the backbone of our civilization and appreciate the value of this organization, the American Society of Mechanical Engineers.

Permit me to extend greetings to your organization and its members throughout the country, and indeed the world, on the fortieth anniversary of your founding. In few directions has America so emphatically demonstrated continued leadership as in engineering. Wherever there have been great problems of construction and development requiring the genius to dominate or to subjugate the forces and materials of nature, there the talents of the American engineer have been in demand. The modern world owes a debt to your profession that can never be overestimated, a debt that in the great period of reorganization, rehabilitation and advancement which now opens before us will be further increased. Please accept my congratulations on the anniversary of your society and best wishes for your continued prosperity and for the expansion of your world-wide field of opportunity and usefulness.

(Signed) WARREN G. HARDING.

Combination mechanical science from our two great countries ought to be bright example to world.

(Signed) ASPINWALL,
Honorary Member, London.

(Continued from page 518)

This will be possible too in most of the sections when the new Kings River plants are brought into the line at Sanger and the new steam plant at Button Willow is constructed and the line looped through it, because the supply points will be so distributed along the line that sections can be taken out without separating a substation from one of the other sources of supply. It is possible, therefore, to maintain practically continuous service even though replacements will become necessary at some future time.

Calculating Transmission Line Economies

In methods of making calculations of transmission line economies, practically all writers agree on considering the conductor only, or rather that the price of conductor is the only variable in the equation. This may be true where tower lines on private rights-of-way are considered, but where transmission lines on single poles along public highways are considered, it seems that the cost of supports must also be a variable. The 110-000-volt line described in this paper shows the lowest factor of safety against horizontal loads and if the size of the conductor were increased and the length of spans left the same, the line would be weak against horizontal loads. The supports must be spaced more closely or a different type must be used. Closer spacing means more insulators and the cost per mile of the line would show a much greater increase than that caused by the increased size of the conductor alone. "A"

American engineers in Cuba offer congratulations, fortieth anniversary. Atlanta Section sends greetings. Congratulations on your Section's growth.
(Signed) METROPOLITAN SECTION.

Heartiest greetings on occasion fortieth anniversary. Events recent years which demonstrated importance of engineers to civilization and established their power in industrial world indicate necessity for continued expansion of engineering societies' activities.

(Signed) INSTITUTION OF MECHANICAL ENGINEERS
OF LONDON.

No creation of wealth can be termed civilization unless coupled with high ideals. These are urgently needed for next move of civilization which is awaiting results of the efforts of engineers uniting with and doing service for the community.

(Signed) DE FREMINVILLE,
Honorary Member, Paris.

As president of the American Federation of Labor, it is my firm conviction that the labor movement not only welcomes but invites your cooperation.

(Signed) SAMUEL GOMPERS.

Institution Civil Engineers, London, congratulate American Society of Mechanical Engineers on fortieth anniversary and on their leadership in industry.

Greetings. Forty years of achievement by the engineer has produced a mechanical age greater than that of all time combined and is a challenge to the present generation that calls forth our best endeavor; therefore we accept the responsibility and pledge ourselves to become better engineers, better citizens with better ideals rendering unselfish service to humanity.

(Signed) PRESIDENT-ELECT E. S. CARMAN.

The greatest constructive work before the engineers of the United States is the creation of a sense, mutual between employer and employe, to apply the same skill to development of the human side of our employment relations that we have devoted to our machines and our processes. Our engineers stand midway between the employer and employe in intimate contact with both. It is the engineer's problem, and I consider the very fact that your meeting is devoted to its consideration is a step into a field of engineering that is more fundamental to our material welfare than any other issue before our country.

(Signed) HERBERT HOOVER,
The American Society of Mechanical Engineers.

Greetings from the Commonwealth of Massachusetts to all celebrating the fortieth anniversary American Society Mechanical Engineers. We were always supported heartily in civic works by your society and know that further support will increase rather than lessen. With best wishes for each and every one,

(Signed) CALVIN COOLIDGE.

Congratulations to society on its fortieth birthday. City of Boston appreciates assistance of engineers in municipal problems.

(Signed) ANDREW J. PETERS, Mayor.

Boston Section and Dean Anthony Tufts College send greetings.

Greeting and best wishes from the St. Louis Section. We hope that the spirit of the anniversary celebration may join us all closely into one unit, advancing irresistibly toward national progress for the benefit of mankind.

(Signed) ST. LOUIS SECTION, A. S. M. E.

frames or "H" frames could be used, and would keep the number of insulators down, but this would require at least one of the poles of the frame to be placed on private property and the right-of-way question is immediately raised.

In making the economical calculations for this line, estimates were prepared on the costs of one mile of line using different sizes of aluminum conductors and varying the pole spacing in line with the discussion just given. Then the annual charges per mile of line were calculated on the basis of 9% interest, 4% depreciation and 2% maintenance and the results plotted against the annual cost of the power lost per mile of line at 5.25 mills per kw-hr. Then according to Kelvin's Law the line which shows an annual charge equal to the annual cost of power lost, or in other words, the line indicated by the crossing of the curves of annual cost and the power lost for the given load, is the most economical line. It will be noted from the curve sheet here shown that with an aluminum conductor of 266,800 c.m. cross section, the economical load is 20,000 to 21,000 kw. at 100% load factor and a power factor of 85% lag, which is roughly the same as 30,000 kw. at a 70% load factor. The critical disruptive corona voltage for that size conductor at sea level at a temperature of 120° F. is approximately 130,000 at a spacing of ten feet between conductors. It was then chosen as being the most economical conductor for the load as well as being safe from corona at the operating voltage of 110 kw.

LATEST IN EVERYTHING ELECTRICAL

(A year ago who would have thought of going to the electrical contractor-dealer for a manicure set? Yet here it is, all nicely electrified and ready for the market. Other products of the West presented on this page are two new ironers, one being manufactured in Seattle and the other in Chicago. The water powers of British Columbia and the new Who's Who, reviewed from a Western standpoint, are among the books and bulletins presented here.—The Editor.)

ELECTRIC MANICURING

The Electric Manicuring Company of Los Angeles has recently been incorporated for the purpose of manufacturing and selling an Electric Manicuring Set.

The outfit consists of a small Westinghouse electric motor, attached to which is an adjustable shaft, and to this a circular file, cuticle point, emery



The new electrified manicure set

board and buffer can be attached as needed. By use of a quickly detachable tool attachment, it is not necessary to stop the motor to change the tools.

The manufacturers state that by this method a manicurist can accomplish three times as much in a day as by the present method.

THE "UNIVERSAL" CLOTHES WASHER

A washing machine which combines unusual features of mechanical construction, safety and appearance is being placed on the market by Landers, Frary & Clark of New Britain, Connecticut. This covers a floor space 24 by 30 inches with a tub $36\frac{1}{4}$ inches and weighs 285 lbs. Its manufacturers state that this machine combines the advantages of the revolving and oscillating type.

NEW IRONER IS AUTOMATIC

The new Thor Electric Ironer is described by the manufacturer, the Hurley Machine Co., as representing a new mechanical departure in electrical home labor saving appliances.

A touch on a small lever, placed on the feed board, throws the shoe into gear with the motor and the shoe moves into one of three open positions or into the closed position, as the operator may desire. Two buttons placed on the control lever are shifted up and down according to the position into which the shoe is to be moved, leaving the hands free to guide the pieces being ironed.

The roll is given two speeds, one a standard speed of eight feet per minute for heavy pieces, and the other a $12\frac{1}{2}$ -ft. per minute speed for handkerchiefs, towels, and other light pieces.

SPARTAN VACUUM CLEANER CONNECTOR

Manufacturers of electric vacuum cleaners have experienced some difficulty in obtaining devices which are best suited for connecting the wires from motor to the switch connection at the lower end of the handle. To meet this need, the Bryant Electric Company of Bridgeport, Conn., offer the Spartan Receptacle-handle connector No. 138.

A heavy fibre tube which is longer than the porcelain connector body is provided to insulate the binding screws or wire terminals from the handle. The body of the connector is provided with contact slots for plug caps and binding posts for wires which are staked and riveted. This connector is $1\frac{3}{8}$ in. long by $\frac{7}{8}$ in. diameter, with a slight flange $1\frac{3}{16}$ in. diameter to hold the device at the end of the handle.



Connector Cleaner

MERCER IRONING MACHINE

The Western Appliance Manufacturing Company, Seattle, maintaining offices in the Railway Exchange Building, recently began the construction of a factory wherein will be manufactured the Mercer Ironing Machine which, in the opinion of its inventor and manufacturers, is destined to take its place among the leading machines of its kind now on the market. It has such features embodied in its general construction as an ironing shoe opening a total of six inches from the roll. The transmission consists of a belt drive to a worm gear which in turn revolves the roll together. Sufficient machinery for the manufacture of 500 machines per month is on the ground and will be installed as soon as the factory is completed.

Books and Bulletins

Water Powers of British Columbia

This comprehensive report of the Canada Commission of Conservation compiled by Arthur V. White, consulting engineer with the commission, is a summary of all data relating to the water-power resources of British Columbia.

The principles which should govern in the conservation and utilization of inland waters and a complete compilation of stream flow and meteorological data on the more important streams of British Columbia make up the major portion of the book. A survey of water legislation in the Province adds to the value of the bulletin as a handbook on the power situation of Western

Canada. Views of the beautiful rivers, lakes and falls of British Columbia make the report of unusual interest.

Who's Who in America—1920-21

The eleventh biennial issue of Who's Who in America, now being distributed, contains 23,443 biographical sketches of leading living Americans, 2,514 of which did not appear in the previous edition. As usual, the latest address is appended to each sketch and the index by state and post office address is retained.

The following Western engineers have been added this time to the list of Westerners which appeared in previous issues: Stanly Easton, manager Bunker Hill & Sullivan Mining & Concentrating Company; S. M. Kennedy, vice-president and general agent Southern California Edison Company; R. H. Ballard, first vice-president Southern California Edison Company, and P. M. Downing, vice-president in charge of electrical construction and operation, Pacific Gas & Electric Company.

For the Mine

The extent to which electricity can be used in the mining industry is forcibly brought out in a recent publication



One view of a typical mining district covers the front and back covers of this recent C-H publication.

of the Cutler-Hammer Manufacturing Company which appears under the title "For the Mine." The applications presented with the aid of illustrations appear under the following headings:

Motor Controllers for Direct Current Service; Motor Controllers for Alternating Current Service; Accessories; Battery Charging Equipment for Miners' Lamps and for Battery Locomotives; Brakes—Electrically Operated; Iron-Clad Solenoids; Magnetic Separators; Magnetic Clutches; Electric Space Heaters and Electric Soldering Irons.

New Pelton Bulletin

A complete diagram of the typical installation of a Pelton Pump in a Pit appears on the first page of the new Bulletin No. 11A of the Pelton Water Wheel Company. Following this is a page illustration which shows the structure of the Type B Centrifugal Pump and later some rating tables of interest to any who have to do with this type of machinery. A diagram showing the use of an automatic float switch and a plan for an irrigation plant also go to make this a noteworthy publication.

NEW ELECTRICAL DEVELOPMENTS

(The erection of several large industrial plants which will be noteworthy consumers of electricity is reported from the Northwest and also from the Pacific Central District. From Arizona come plans for completing the survey for the Colorado river basin project while Southern California reports the opening of a new power plant and the erection of two large factories. Items concerning the extension of power company distribution and generation systems predominate among those from the Intermountain district.—The Editor.)

THE PACIFIC NORTHWEST

REEDSPORT, ORE.—The town of Reedsport is contemplating the purchase of the plant and distribution system of the Reedsport Light & Power Company.

OLYMPIA, WASH.—The Northwestern Electric Company, with main offices in Portland, Oregon, has increased its capitalization in Washington to \$22,000,000.

MARSHFIELD, ORE.—The Marshfield Mill & Timber Company's new electric mill is now in full operation. It is the only complete electrically operated mill in Coos county and is cutting 20,000 feet of lumber a day.

SALEM, ORE.—The Pacific Telephone & Telegraph Company has filed application with the Public Service Commission of Oregon, for a general increase in rates on its various properties throughout the state.

SEATTLE, WASH.—The Power Plant Engineering Co., a new corporation, has been capitalized at \$25,000, and will engage in a general engineering, constructing and manufacturing business in Seattle.

ELMA, WASH.—The Public Service Commission has suspended the proposed increase in rates of the Northwest Electric & Water Company for a period of 90 days pending a hearing. The company operates in Elma, Montesano, Satsop and intermediate points.

SALEM, ORE.—A total of 88 permits covering the use of water for irrigation of approximately 3400 acres of land and the development of 540 hp. were issued by State Engineer Cupper during August and September, according to a summary.

ASHLAND, ORE.—Harry Silver, manager of the Pompadour Mineral Springs, has recently closed a contract for the erection of a plant which will liquidate natural carbonic gas and sell the product in the East. The company has a capital stock of \$25,000.

TACOMA, WASH.—City officials feel that the Lake Cushman power site must be acquired since the demand for power has been beyond the limit of the La Grande power plant of the city. This increased demand is largely due to the increased growth of the city.

TACOMA, WASH.—The city council has approved plans of the Light and Water department for a supply, warehouse and shop building. The proposed structure will be 200 by 100 ft., of reinforced concrete construction, two stories in height. The cost will approximate \$75,000.

SEATTLE, WASH.—Contractor D. G. Lebb and his assignee, J. A. Harris, both of Portland, Oregon, recently filed a \$50,000 foreclosure lien suit in the Lewis county court at Chehalis, Wash., against the Sherman County Light & Power Company, a subsidiary of the Washington-Idaho Water, Light & Power Company.

HOQUIAM, WASH.—A large paper mill may be built in the addition of Woodlawn. By utilizing waste materials power will be furnished and raw materials for the mill would be secured for several years from the logged off land in this vicinity. Water for the plant would have to be brought from the East Hoquiam river in a viaduct.

TEKOA, WASH.—The termination of a controversy over the light and power franchise under which the Washington Water Company operates its system in Tekoa came to an end when the company submitted a complete sub-

rogation to the terms of the franchise. Definite action will be taken by the council at its next meeting.

TACOMA, WASH.—The business of the municipal light department for the month of October, 1920, showed an increase of 64.2 per cent over the same month of 1919, according to statistics filed by the department. This was exclusive of power sold the nitrogen plant at La Grande, and represents the tremendous growth in the use of electricity by the growing city of Tacoma.

SEATTLE, WASH.—Mayor Caldwell, in a letter to the city council, recommends the sale of the \$600,000 Skagit River bond balance to the highest and best bidder, rather than by the plan of selling the bonds over the counter in small lots. About \$360,000 of the securities have been sold in this way. The balance remaining will be needed next month to further finance the development at Skagit River.

HOOD RIVER, ORE.—Application has been filed with the Federal Water Power Commission at Washington by the Columbia Valley Power Company, for a permit for power to develop the Deschutes river. New York capitalists are behind the project and it would seem that they are making definite plans for the development. It is estimated that the power sites are capable of producing 380,000 hp.

AURORA, ORE.—The main offices of the Mollalla Electric Company will be moved from Canby to Aurora, according to announcement made by E. G. Robinson, manager of the company. The move is being made to Aurora as it is a more central point since the Mollalla company has been purchasing power from the Portland Railway, Light & Power Company at Woodburn.

PORTLAND, ORE.—The Portland Vegetable Oil Mills Company, capitalized at \$1,000,000, will soon commence the erection of a plant in Portland, which will have a capacity for crushing 100 tons of copra (dried coconut) a day. This will require the importation of copra having a value of more than \$4,000,000 a year, and a value of finished product of over \$6,000,000 a year. The mill will be electrically operated throughout.

SEATTLE, WASH.—According to William Tupper, president of the Tupper Manufacturing Company of Seattle, this plant, which was established something over a year ago, is now turning out 10 electric dishwashing machines daily. The company specializes in the manufacture of dishwashers of all sizes, and according to Mr. Tupper is having a hard time to keep up with the orders received.

YAKIMA, WASH.—A total of nearly a million dollars is being spent in canal and drainage improvements in Yakima valley this year despite reports that the project is at a standstill. The Indian reclamation service is spending the bulk of this in distributing the \$475,000 appropriated by Congress, but in addition to this, six of the larger canal companies are spending from \$10,000 to \$30,000 in betterments, and the county a total of \$344,000 for its drainage program. The various projects comprise an area of about 40,000 acres.

SALEM, ORE.—The Fort Klamath Meadows Company, of Fort Klamath, through the law firm of Ferguson & Fletcher of Klamath Falls, recently applied to State Engineer Percy A. Copper for a permit to appropriate 70 second-

feet of water from Anna creek, tributary to Wood river, to be used in developing power. A dam of concrete five feet high and 20 ft. long, with wasteway over the center, will be constructed. Plans also call for an iron headgate with screw lift gate five feet in diameter, set in concrete; 10,100 ft. of pipe; a Pelton water wheel and a dynamo. The total cost is estimated at \$50,000.

THE PACIFIC CENTRAL DISTRICT

OAKLAND, CAL.—The lease of land for a new six-minute automobile ferry has been ratified.

REDDING, CAL.—The Pacific Gas & Electric Company is going to spend approximately \$20,000 to give Redding a better water supply and safer fire protection.

OAKLAND, CAL.—A building permit has been issued for the construction of a \$40,000 concrete garage on the north side of Hobart street, 175 feet west of Broadway.

FRESNO, CAL.—Power users of the San Joaquin Valley have been assured by the San Joaquin Light & Power Corporation that more than 3,000 new extensions will be made to take care of applications for power.

OROVILLE, CAL.—The Friesley Air Craft Corporation has started the construction of its large manufacturing plant near Gridley. It is planned that the plant will be one of the largest airplane plants in northern California.

MODESTO, CAL.—A block of \$505,000 worth of Don Pedro project bonds will be placed on sale by the Modesto district and a \$2,570,000 block by the Turlock district, at 2 p.m. on the afternoon of December 14.

OAKLAND, CAL.—Plans for Oakland's proposed combined state armory and exposition building were outlined recently at a meeting of representatives from the Merchant's Exchange, Chamber of Commerce and National Guard organizations with the mayor.

FRESNO, CAL.—Anticipating the fast growing needs for big material, the California Peach Growers have closed a contract with the government by which it acquires timber amounting to 60,000,000 ft. In addition the company has also purchased \$10,000,000 ft. from the Yosemite Power Company's plant.

FRESNO, CAL.—Building operations amounting to nearly half a million dollars, in which the California Peach Growers are interested, have been announced by the general manager of that company. This total includes the joint construction of a \$200,000 office building with the California Associated Raisin Company.

RICHMOND, CAL.—The coming of a \$1,000,000 manufacturing corporation with Eastern connections and the sale of \$150,000 in harbor bonds for immediate construction of another unit of the Richmond city terminal on the inner harbor are announced as items which tend to show the rapid industrial growth of this city.

VISALIA, CAL.—Bids will be opened on December 16 by the Tulare County Board of Supervisors for a natural gas franchise for this county. An application for such a franchise was formally presented to the board by F. A. Cleveland, representing a syndicate owning extensive gas wells in the Tulare Lake region. The syndicate expects to supply the towns of Tulare and Kings counties with the natural fuel.

STOCKTON, CAL.—Private individuals have made application for use of part of the natural flow of the north fork of the Stanislaus river. It is contemplated to erect a power plant at the headwaters of the river to develop about 9,600 horsepower, involving an expenditure of \$2,000,000.

SUNNYVALE, CAL.—The Federal Paulson Construction Company will erect a large wireless station about 1500 feet away from the port of Sunnyvale. The cost of the plant will aggregate \$160,000. The foundation is to be laid soon, the steel framework being already on hand for the superstructure.

MARTINEZ, CAL.—The Petroleum Products Company has announced that it obtained from the supervisors of Contra Costa county a twenty-year lease for a wharf franchise at Oxol, Carquinez Straits, between Port Costa and Martinez, for its new refinery. An application is before the Railroad Commission for utilization of the pier.

WILLOWS, CAL.—According to the weekly record of deeds published, several rights-of-way have been granted to the Mt. Shasta Power Company. This company, a branch of the Pacific Gas & Electric Company, will erect a steel tower line from Pit river to the coast. In its course it will run through the western part of Glenn county.

SAN FRANCISCO, CAL.—The establishment of a large brick factory in San Francisco within the early future by the International Bricklayers' Union to meet the dual purposes of reducing building costs and increasing the use of brick as a construction material, has been announced. The plant contemplated will cost in the neighborhood of \$250,000.

RICHMOND, CAL.—The manufacturers' bureau of the Richmond Chamber of Commerce will take up with the San Francisco-Oakland Terminal Railways Company the proposition of extending the Eighth Street line out through the factory district, and as far as the Giant Powder Works at Giant. There are 1000 employees of factories in the northern section of the city not being served by any car line at present.

SACRAMENTO, CAL.—The 15 per cent surcharge which the Pacific Gas & Electric Company added to its arc lighting bills, and which the Great Western Power Company added to the "stand-by charge" for stringing a line to the City Sump, are legal charges against the city. This was the opinion which has been given to the City Commission by City Attorney Robert L. Shinn.

SAN FRANCISCO, CAL.—A recent order of the Railroad Commission, following an investigation of the practices of the Sierra and San Francisco Power Company as to extensions for electric service, directs the application of the rules of the Pacific Gas & Electric Company to the Sierra properties. The properties of the Sierra Company are now operated under lease by the Pacific Company.

RICHMOND, CAL.—With the news that the Santa Fe Railroad is to resume its ferry operations between this city and San Francisco on December 5, the information has been secured that the branch line of the road between Richmond and Oakland is to be electrified. For some time the head officials have been securing bids on the cost of making this important change, and contracts for the work are to be awarded in a short time.

SAN JOSE, CAL.—The water conservation survey in Santa Clara Valley is progressing favorably with several expert engineers in the field. All the irrigation wells are being mapped; some hundreds of them have been selected as observation wells; water levels from side to side and end to end of the valley are being ascertained, and possible reservoir sites on several local streams located. It will be four or five months before the final reports of the engineers will be made.

THE PACIFIC SOUTHWEST

SAN DIEGO, CAL.—A \$500,000 gypsum company has been organized to develop huge deposits in Imperial Valley.

PRESCOTT, ARIZ.—An ornamental street lighting system is being planned. Single globe standards will be used, nine of these to be built in each block at 100-ft. intervals.

LOS ANGELES, CAL.—The Sunset Glass Manufacturing Company will start the construction of a new plant here at an early date. It is estimated that the expenditure made by the company will involve \$250,000.

EL CENTRO, CAL.—Break-downs and interruptions in power and light supply for Imperial Valley consumers were declared to have ended with the completion of the Holton Power Company plant here under direction of Frederick Stierel, an Eastern expert.

SAN BERNARDINO, CAL.—A storage battery factory is being contemplated for this city, for the manufacture of a new type of automobile battery based upon patents that have been secured by W. L. Gill. The output of the factory is to be 500 batteries per month. Capital stock, \$60,000.

CASA GRANDE, ARIZ.—Committee work in the development of the plans for establishing the San Carlos Power District is going forward steadily. The legal problems naturally arising in such cases are being carefully considered by competent authorities and further figures are being worked out relating to the mechanical side of the proposition.

YUMA, ARIZ.—The report of A. P. Davis, director of the United States reclamation service, on the tentative Boulder canyon project on the Colorado river basin, has been sent from here to Washington and will be presented to Congress December 6. The boards of directors of the Coachella Valley Water Users' Association and the Imperial Irrigation System have agreed to raise the \$40,000 necessary to complete the survey. It is estimated that the entire project will cost at least \$75,000,000.

LONG BEACH, CAL.—Roaf & Purington, construction engineers, have been awarded the contract for a half-million dollar irrigation enterprise in Arizona. The owners of 10,000 acres and water rights involved in the project are mostly former Santa Fe Railroad men, who have organized a syndicate known as the Walapai Land & Irrigation Company. Construction of a dam near Hackberry and the building of between 18 and 20 miles of canals are details of the undertaking. The main body of land to be reclaimed is near Kingman.

PHOENIX, ARIZ.—The Hoepfner Electric and Machine Company has been given the largest electrical contract ever known in Arizona, and probably in the whole Southwest. This was the contract for wiring and the installation of motors and electrical fixtures of every description in the new Arizona Packing plant, the work of which is now just being completed after extending over a period of several months. The work included wiring, placing of conduits, and installation of switchboards and lights, as well as of electrical motors, 66 in number, and having a combined capacity of approximately 1000 hp.

THE INTER-MOUNTAIN DISTRICT

ST. GEORGE, UTAH.—The Dixie Power Company has completed its line to Silver Reef and electric power is now being used to hoist the ore from the mines in that district.

BOISE, IDA.—Application has been made by the Idaho Power Company to the public utilities commission of Idaho, asking that a date be set for its hearing on the valuation of the company's physical property.

EUREKA, UTAH.—Extensive improvements are being made in the street lighting system in Eureka. The plan recently adopted by the city council is to increase the candle-power of each, and to discard the old style incandescents.

FILLMORE, UTAH.—Preliminary plans are under way by the Telluride Power Company to extend its power line from Fillmore through the artesian well belt, on to McCormick and thence to Delta and other towns in that territory.

SALT LAKE CITY, UTAH.—Bids are being requested by S. Q. Cannon, city engineer of Salt Lake City, Utah, covering the installation of about one mile of additional street lights to correspond to the ornamental system installed there in 1919. The present system covers five-eighths of a mile of down town streets.

SALT LAKE CITY, UTAH.—Application has been made by the Utah Power & Light Company to the public utilities commission of Utah, for a certificate of convenience and necessity to extend its lines for furnishing light, power and fuel service to the new mill of the Utah Consolidated Mining Company in Tooele county.

PROVO, UTAH.—F. W. C. Hathenbruck, of Provo, in an application filed with the state engineer, proposes to develop six second-feet of water from the subsoil or subterranean flow in Slate canyon, Utah county, and to harness the flow to operate a 300-horsepower hydroelectric plant with which to mine on Slate placer claim No. 1 at Provo.

NEPHI, UTAH.—The Big Springs Electric Company of Fountain Green is negotiating with the town of Levan in regard to extending its lines to that town. The company is now figuring on building a line down Nephi canyon, and through the valley to Levan if the necessary franchise can be obtained and arrangements can be made to finance the proposition.

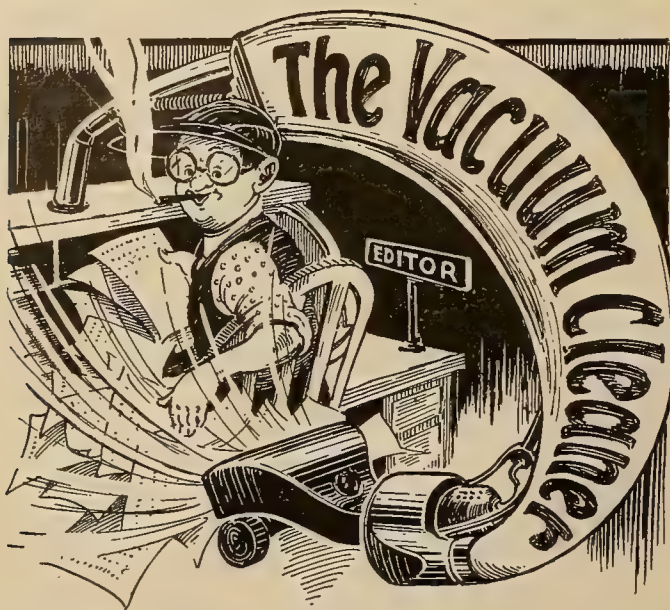
GOLDEN, COLO.—E. A. Phinney, president of the Jefferson County Power & Light Company, appeared before the city council at its recent meeting and discussed the matter of an application for an extension of the company's franchise in this city for a term of 20 or 25 years. The present franchise of the company has some time yet to run, not expiring until January 4, 1924.

ELKO, NEV.—Extraction of high-grade petroleum from shale is proceeding two miles from Elko, where the experimental distillation plant of the Catlin Shale Products Company is in operation. The material treated is yielding fifty gallons of high-gravity oil to the ton of shale, from which gasoline, paraffin wax, ammonium sulphate and producers' gas are extracted. No attempt is being made at present to market the crude oil.

DAYTON, NEV.—The all-steel dredger of the Gold Canyon Dredging Company, which was described recently in the Journal of Electricity, is handling approximately 5,000 cubic yards of gravel daily and digging to a depth of twenty to twenty-five feet. The material at present worked is stated to average 25 cents to 30 cents per cubic yard and the electrically operated and partially electrically welded goldship is reported to be earning excellent profits.

EUREKA, UTAH.—The electric power line to the new shaft of the South Standard Mining Company has just been completed and all the transformers have been installed. All the machinery has been moved over to the new shaft and the material for the foundations is also on the ground, the excavating having been completed some time ago. It is understood that an extensive campaign of development work will be carried on at this property during the fall and winter.

FLORENCE, COLO.—Judge Bell of Denver and W. B. Riley of Colorado Springs, representing the State Industrial Commission, were in Canon City recently and heard the application of the employees of the Arkansas Valley Light and Power Company to have a stipulated sum of money paid them by the company instead of the bonus which they have been receiving for the past four years, which was based on the saving they were able to make in the use of coal at the company's Canon City plant.



Business records are not always as helpful as they are thought to be. A northwestern power company recently had occasion to go through some musty records, and among entries in its books, encountered the following items.

"One donkey employed clearing camp site together with thirty other men.
 "Two series transformers for gump pump.
 "One old man (badly bent).
 "Twelve small teeth for hack saw blade.
 "Six gazzizzas.
 "Two dead men seven feet long.
 "Labor on proposed alterations.
 "One sceptic tank.
 "One snow pump.
 "Labor on meaters.
 "Two serious transformers.
 "Twelve indecent lamps."

* * *

A new industry seems to be indicated by a sign we saw recently:

"We use customers' own skins in making up furs."

* * *

A firm hand is necessary in some branches of the export business, judging by a recent trade announcement reading:
 "British concern offers prompt shipment of refractory goods."

* * *

Banking has some "unexpected angles," according to a recent speaker. He was probably thinking of the colored lady who walked into the bank one day and planking down the savings of several years, remarked:

"Ah wants you should take care of dis yeah cash fo' a while."
 "Why, Chlorine," ejaculated the teller, who knew her of old, "I thought you always said you'd never trust the bank."
 "Dat's all right, dat's all right; but de circumferences surroundin' de matter makes me change mah mind. Yo' see, I'se gwine get married an' Ah don't want dat much money round de house with no strange cullid man on de premises."

* * *

Parliamentary procedure sometimes leads to action, apparently. We find the following in the minutes of a recent meeting:

"Proposal No. 19
 Waiting Period

Mr. Jones moved to lay on the table till next meeting."
 —from which we gather that Mr. Jones was forcibly prevented from passing the time between the two meetings in his own way.

Telegraphy has its disadvantages. A sailor summoned for assault was asked by the patrol office why he struck the telegraph operator. He replied:

"Well, sir, I gives him a telegram to send to my gal, an' he starts readin' it. So, of course, I ups and gives him one."

* * *

At first sight the following trade announcement looks bad:

"A manufacturer in Argentina is in need of veterinary drugs and remedies, motors and lighting sets to operate on alcohol." Industry seems to be rather unhealthy down there;—going to the dogs, in fact.

* * *

The education of the public has ever been one of the planks in the electrical industry's platform. As a shining example of this spirit we quote the story of the sweet young thing who was being shown through the Baldwin locomotive works. "What is that thing?" she asked, pointing with her dainty parasol.

"That," answered the guide, "is an engine boiler."

"And why do they boil engines?" she inquired again.

"To make the engine tender," politely answered the resourceful guide.

* * *

Preparedness is not necessarily synonymous with safety. Witness one Pat Murphy who, when asked what was bulging in his vest pocket, replied:

"Dynamite. I'm waitin' f'r Casey. Every toime he meets me he slaps me on th' chist an' breaks me pipe. Next toime he does it he'll blow his hand off."

* * *

Einstein's theory of relativity, or some similar obsession, must have been afflicting a certain young city salesman who was traveling through the mountains of Virginia. On the top of a divide he met the star-route mail-carrier.

"What time is it?" he asked.

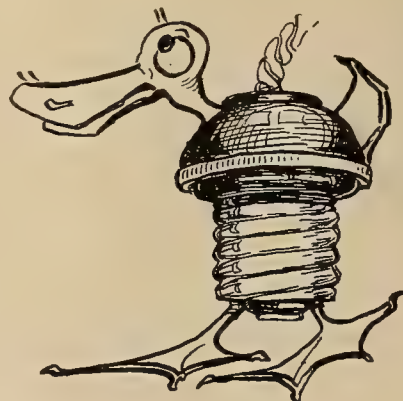
Pulling out his watch, the mail-carrier replied:

"It's three o'clock by railroad time."

"By railroad time!" said the young man. "It looks to me like you people 'way back here in the mountains would use sun time!"

"What for, young man? We are a damned sight closer to the railroad than we are to the sun."

* * *



ELECTRICAL HYBRIDS — III.

The Electric Plugly Duckling

The Plugly Duckling, though he's plain,
 Has very good connections;
 He fits, when given outlets,
 In the most exclusive sections.

IN THIS ISSUE: A Year of Electrical Progress in the West

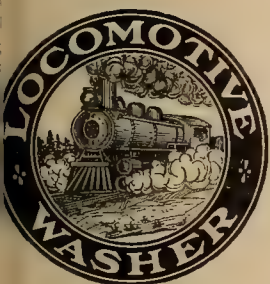
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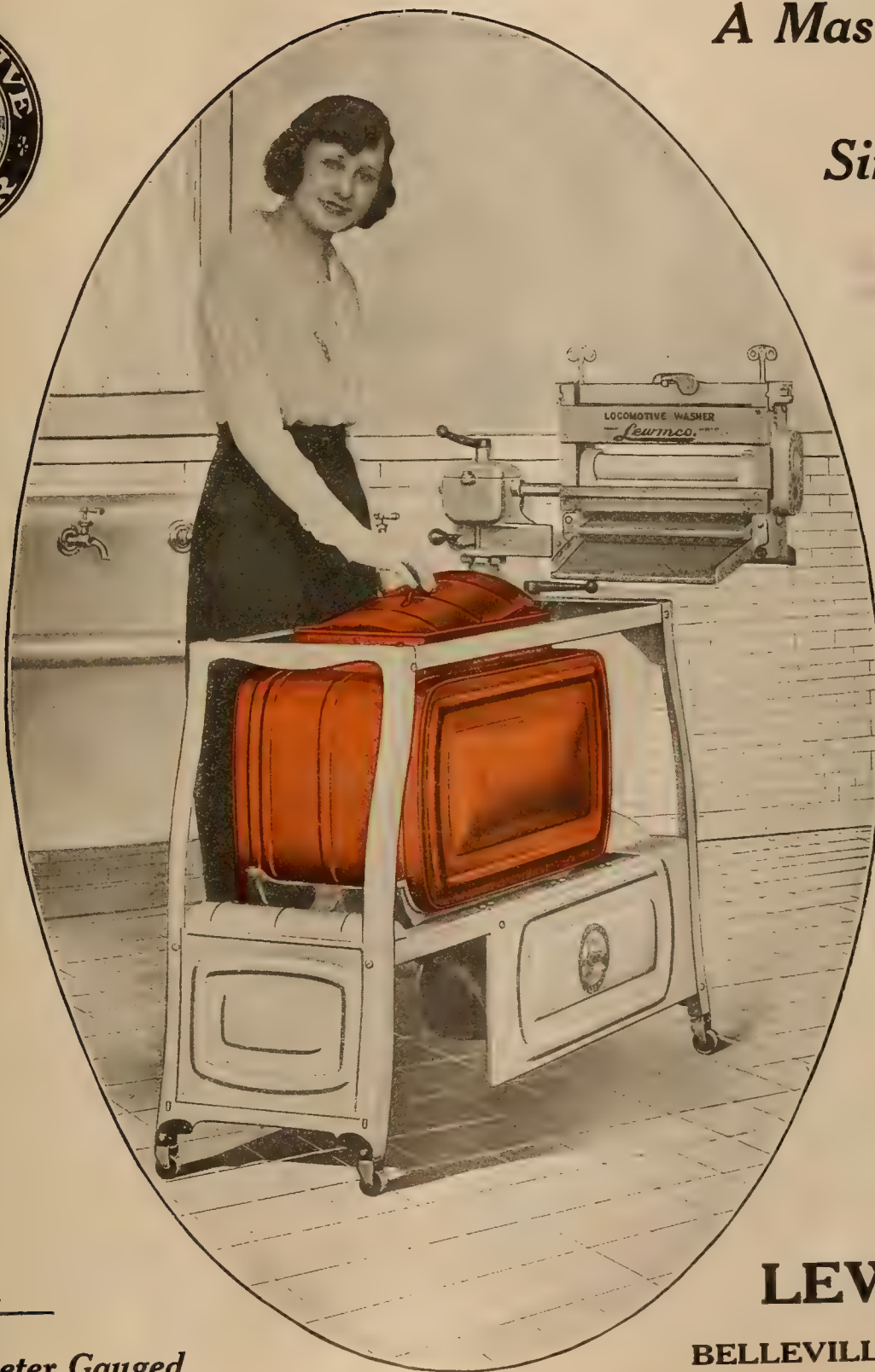
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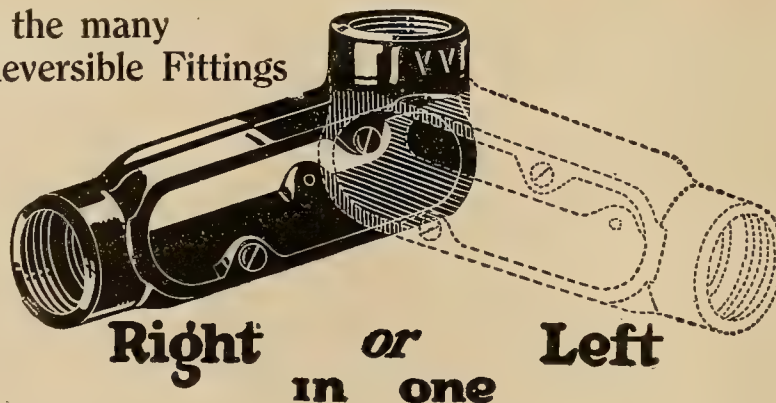
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of
Simplicity*



*Simply
Constructed—
Yet Micrometer Gauged*

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BELLEVILLE, ILLINOIS

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V. V. Reversible Fittings



A Triumph of Inventive Genius

"'V. V.' reversibility is the biggest improvement made in the past decade in this branch of the electrical industry." That is the statement made by men qualified to judge.

Many contractors, electricians and electrical engineers are still clinging to conduit fittings which are usable in **only one way**, possibly not knowing that this is no longer necessary. As a result, when the workman out on the job comes to a right turn in the conduit, and only a left elbow is available, he is **DE L A Y E D**.

With "'V. V.'" (VICE VERSA) FITTINGS he keeps right on working, for a "'V. V.'" elbow is both right and left. And this is but one of the many reversible types of V. V. FITTINGS.

This big, exclusive feature of "'V. V.'" FITTINGS — **REVERSIBILITY**, is a mighty important feature to men responsible for the installation and maintenance of electrical equipment.

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- They save time in ordering fittings.
- They reduce your stock because they reduce your investment.
- There is no complicated system of terms to remember.
- They save all the red tape and lost time caused by ordering wrong fittings.
- Workmen are pleased with "'V. V.'" FITTINGS. The large wiring space and "straight pull on the wire" feature help them immensely.

If you want fittings that save you money, that are easy to specify, easy to order and easy to install—fittings that save your shelf room, and that can be delivered promptly—all at no more cost per fitting than any other

kind—demand "'V. V.'" FITTINGS. Substitution means that you get a fitting that can be used only one way—possibly the wrong way. So accept no substitutes but insist on "'V. V.'S" Try them on your next job.



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JOURNAL OF ELECTRICITY

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SAN FRANCISCO, DECEMBER 15, 1920

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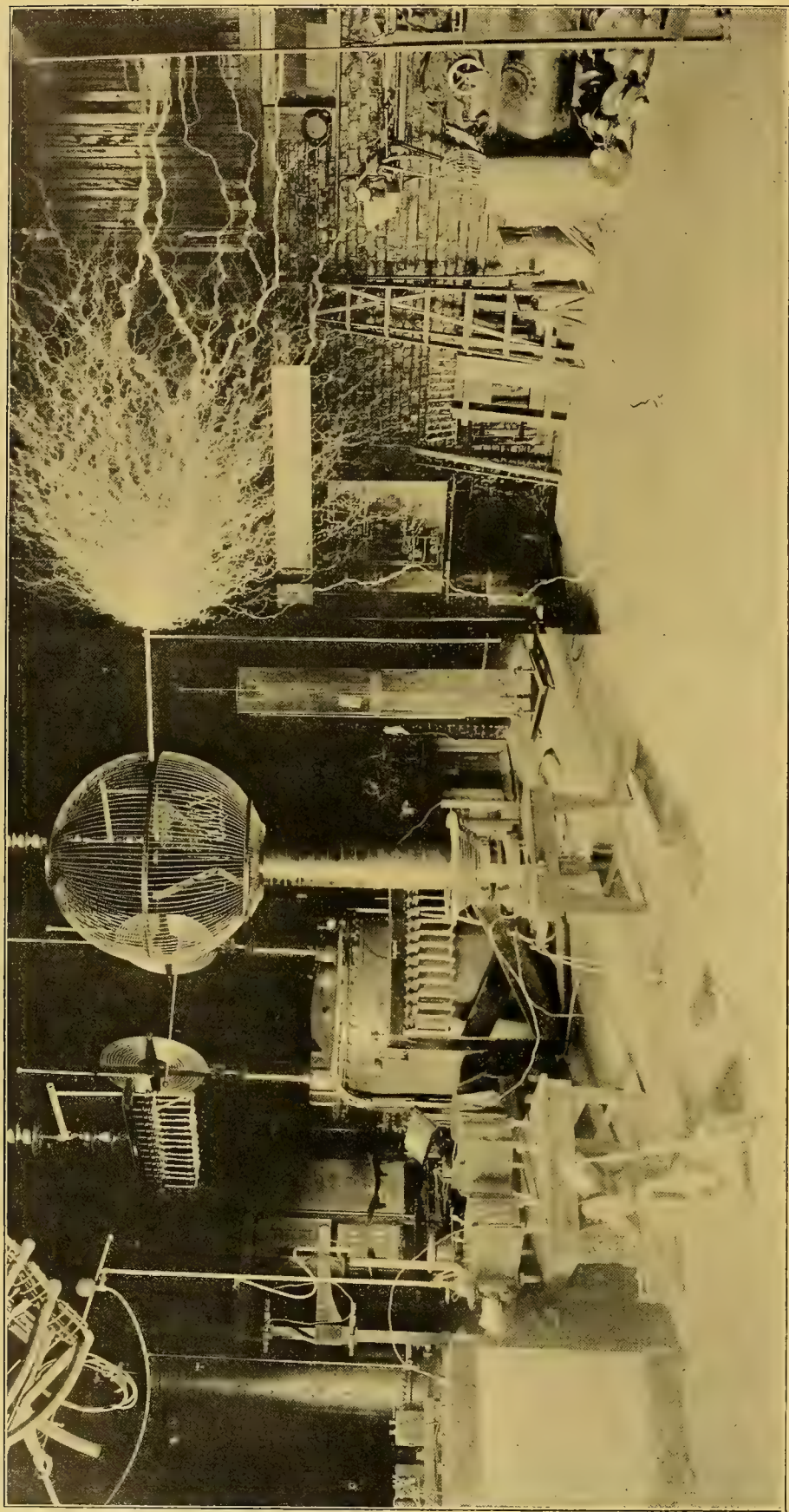
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ELECTRICAL WORLD — JOURNAL OF ELECTRICITY — ELECTRICAL MERCHANDISING



Jumping a 111-inch Spark Gap With 1,660,000 Volts

ONE of the most significant advances made in the past year in the West has been in the field of high tension transmission, in which the West has always led the way. It is not sufficient that the plans for 220,000 volts be worked out theoretically, but the results must be checked up with actual equipment duplicating field conditions

as nearly as possible. This illustration shows the interior of the high voltage laboratory of the Leland Stanford Junior University where Professor Harris J. Ryan of the department of electrical engineering has worked out an oscillator which is here shown operating at 1,660,000 volts discharging over a 111-inch gap to ground.



JOURNAL OF ELECTRICITY



DEVOTED TO THE UPBUILDING OF THE ELECTRICAL INDUSTRY IN THE WEST
AND IN THE COUNTRIES BORDERING THE GREAT PACIFIC

Volume 45

SAN FRANCISCO, DECEMBER 15, 1920

Number 12

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LOOKING BACK—AND AHEAD

THE last day of the business year should be set aside for the purpose of retrospection and for the weighing up of assets and liabilities. Not only the balance sheet should be consulted but also the friends made and lost, the contracts made and lost, and the general reputation and standing of the business. What has the year 1920, now drawing to a close, meant to the electrical industry? Has it advanced as far as was possible in the past twelve months or has it been retarded in its growth by unsettled conditions, bickering between branches in the industry or by a feeling of discontent among the employes of the companies representing the industry and a lack of confidence by the public?

In spite of unsettled financial conditions, power company securities have been absorbed by the market in record-breaking time, showing the confidence of the people in this basic industry. Construction of large plants is now under way all over the West and in California alone there are seventeen projects totaling 390,000 horsepower in the process of construction. The spread of the cooperative idea into the Northwest and the Intermountain district has brought about a unified industry, playing the game "all for one and one for all," with the sole idea of giving better service to the public. The spread of customer ownership of stock and the sales of securities to employes on advantageous terms have made a group of stockholders who are boosters for the industry and who are vitally interested in the welfare of the industry.

Improved methods of merchandising, the spread of the electrical home idea, and closer cooperation between the supply jobbers and manufacturers have marked the increased commercial efficiency of the industry in the past year, while the engineers have set new records in design and installation in almost every possible phase of power generation and distribution.

The convention of the National Electric Light Association held in Pasadena this year gave the West an opportunity to prove the statements it had made for many years regarding those records estab-

lished in hydroelectric generation, transmission and distribution. A practical understanding of cooperation was taken back by those from the East who had a chance to see the results obtained by the California Electrical Cooperative Campaign, and cooperation within the industry was doubtless given a good start as campaigns have been inaugurated in various parts of the country since the convention.

What does 1921 hold in store for the manufacturer? With the plants that are planned and their transmission and distribution systems, the new blocks of power made available for industrial purposes, the increased building activity due to a lowering of building costs and the shortage of homes, it looks like a busy and prosperous year. The jobber and contractor-dealer are going to be busy keeping up with demand for convenience outlets in the modern electrical homes that will be built, and an appliance for every outlet. The power companies have a good wet year ahead which will mean fewer kilowatt-hours produced from steam and the ability to take up contracts and extensions which they have hitherto had to refuse, due to lack of capacity.

With the price of coal and fuel oil going steadily up, and nearly seventy per cent of the undeveloped water power of the United States west of the Rockies, the future holds great possibilities for the development of industries in the West. This however can only be brought about if the power companies are allowed to expand and develop those natural resources, and upon the growth of the central stations depends the growth of the other branches of the electrical industry, of all industries and of the West. Therefore during the coming year every member of the electrical industry should work toward this end—to bring about an electrified West.

DO YOU REMEMBER

—when aluminum conductors were used for the first time by the Snoqualmie Falls Power Company in what was then long distance transmission from the Snoqualmie Falls plant into Seattle?

"The simplest and easiest way for a utility to secure public good will is to offer sound securities to the people it serves. The simplest and easiest way for a citizen to obtain adequate utility service at just rates is to invest money in the utility company. On the one hand the company secures peace and appreciation; on the other, the citizen secures a faithful and responsive public servant."

Customer Ownership of Securities

To these two axioms, stated by William H. Hodge in his article on Customer Ownership of Securities which appeared in the November 20 issue of *Electrical World*, might be added another one. The simplest and easiest way to secure the confidence of the public in the power companies is for other branches of the electrical industry to invest in power company securities. That confidence begets confidence is a well known fact, and when it becomes known that all the members of the electrical industry are purchasing power company securities, the moral effect upon the public will be such that the confidence of the public in their local power companies will be greatly strengthened.

The work of the San Francisco Electrical Development League in organizing a committee to work with a similar committee from the Pacific Division of the Electric Supply Jobbers' Association for the purpose of selling central station securities to members of the industry should be heartily supported. Other electrical organizations throughout the West should make similar drives to carry on this good work of effecting a widespread sale of securities within the industry as a means of proving to the public that the industry has faith in itself and is willing to back up that faith.

Several interesting aspects of the attitude of the public toward their public utilities are brought out by an analysis of the recent report of the California Railroad Commission covering the informal complaints which had been lodged with that body during the year 1919-1920. Of the total of 2663 such complaints, only 487 were questions relating to rates, the others alleging poor service of one sort or another. Telephone and telegraph companies seem to have been the most unpopular, while of the complaints specifically to be charged against electric service corporations, 104 referred to rates, 170 complained of the service and 194 were due to difficulties in regard to installations, extensions and cancellations. An interesting sidelight on the jitney situation is given by figures which show that only 82 complaints were registered against electric railroads, while auto trucks and stages, although these carried much fewer passengers, were the cause of 196 complaints. Practically all the difficulties were adjusted to the satisfaction of both parties.

The comparatively few objections to rates in a year which was marked by frequent upward revisions of the rate schedule is alike a tribute to the reputation for fairness which the Railroad Com-

mission bears and at the same time is significant of a general attitude on the part of consumers, who are willing to pay whatever a service is worth, but are inclined to insist on the quality of that service. What a very small proportion of the electric companies' customers are dissatisfied is to be seen when total figures are compared. Taking the 18 largest utilities in the state, the number of complaints per each 1000 gas and electric consumers ranged from .25 to 6.07, or considerably less than one per cent.

The electrical man who is familiar with the progressive and disinterested work of the various cooperative movements in the electrical industry is occasionally shocked by public scepticism of all alliances labeled cooperative.

Public Scepticism Toward Cooperation

A general flavor of secret sessions and of price juggling has been associated with certain cooperative marketing schemes of his past experience which have started with a flourish of publicity announcing their unselfish purposes and have ended in a lawsuit. Unless he is convinced to the contrary, the ardent reader of his morning paper is inclined to suspect all virtuous movements which may thereafter come under his notice.

It therefore behooves the various electrical cooperative campaigns now under way in the West to see to it that this average citizen does fully understand the purpose and methods of the outlined work. The California Electrical Cooperative Campaign has made such an advertising of its purposes a part of its regular work. The secretary of the Campaign, officers of its Advisory Committee, members of the technical press and others have taken every opportunity to tell of this movement before representative organizations, with the result that more than one body has interrupted with enthusiastic applause. The public as a whole is impressed with the fact that this organization is working in its interest and that its aims mark a new level of business ethics to which other fields of business enterprise might well strive to attain. This warning is sounded as a bit of advice to the new movements now starting who have it within their power either to capitalize their work with returns of public good will or to suffer an inevitable element of suspicion consequent upon misunderstanding. It pays to advertise.

With the extensive construction programs of Western power companies should go a program of educating the public to just what this work really means to the West. Special attention must be given to Mr. Common Citizen who packs a few blankets and a frying pan into his Ford and hies him toward the hills for a vacation. There he finds his favorite camping spot littered up with old concrete forms, finds a rusty pipe sucking the water out of his favorite spring, and comes back to his little circle of acquaintances with a big grief that the electric light company is spoiling the hills for-

The Power Company and the Public

ever. That story goes on and on, getting a little worse for the power company each time.

To counteract such a feeling it will be necessary for the power companies to do some real educational work. As soon as a construction job is finished and everything cleaned up and made spick and span again, make friends with the automobile editor of the local newspaper and take him on a trip over that job. Show him the lake that has been made larger and thus a greater asset to that part of the mountains; tell him of the trout fry planted there. Show him the new roads built and maintained, making that section more accessible and safer for automobile travel. Set up conveniences for auto parties near the reservoirs and other scenic spots on the project, and invite campers and travelers to make use of the properties of the company. By this kind of work the average citizen, the consumer and the nature lover may be made to realize that the construction works of the power companies are really making the mountains more accessible and instead of destroying their beauty are adding to it.

The progress curve of most Western utilities rises at an acute angle, the present capacities of such systems often having doubled within a ten year period.

Factors Involved in Rapid Growth Looking forward into the future, even more ambitious plans are contemplated. One California company, indeed, if it carries out the schedule which it has filed with the Railroad Commission, will be four times its present size by 1930. This rapid growth must be taken into consideration in deciding many of the engineering problems which arise. It is a fact, for instance, that many systems outgrow their equipment before they wear it out, and in consequence it does not always pay to carry out preservative measures which otherwise would prove economies. This fact was brought out in a recent discussion of pole treatment, by an

engineer who stated that his company had found that poles were often replaced in order to make way for equipment to carry higher voltage or for other revision of the system long before they had completed their period of usefulness. The discarded poles have very little value as scrap, being marred both in use and by the process of removal, and are usually reckoned off the books. This situation is not an unusual one, although of course, it is always dependent upon special conditions. The very possibility of these special conditions arising, however, is a factor which must be reckoned with as an element peculiar to the West.

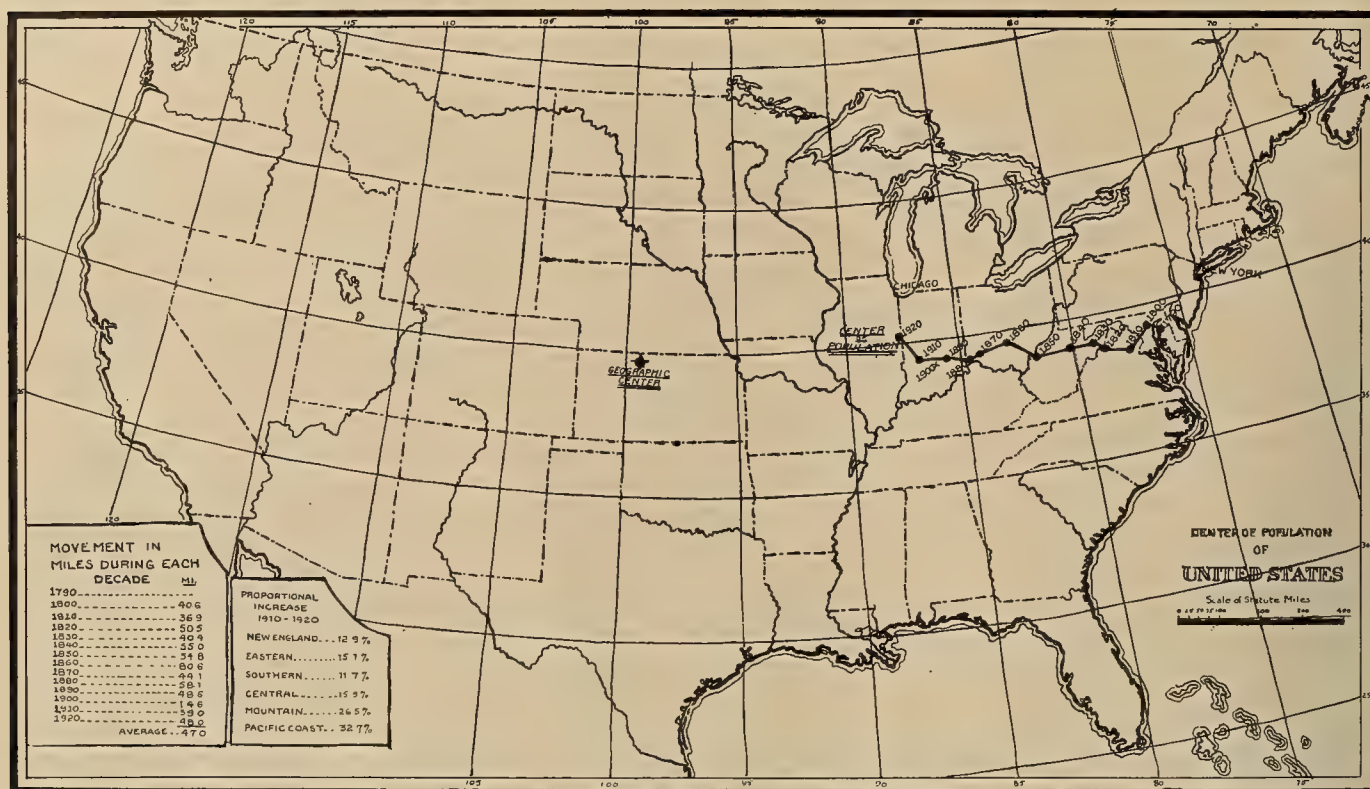
In spite of the popular favor in which water power is held, the company which derives its power from that source labors under one special difficulty in its relations to the public which is not shared by the concern utilizing steam plants. This is due to the misconception of the element of "fixed charges," or the return on investment and other elements which go to make up overhead and which are properly reckoned in as part of the cost of production. The steam utility's costs of manufacture respond quickly to market conditions; both fuel and labor go up in price with a general increase, and it is a simple matter to convince the public that higher rates are a necessity. The labor element is a much smaller item in the hydroelectric system, on the other hand, and with no change apparent in the cost of operating the machinery, it becomes a more difficult affair to satisfy the consumer that a rate increase is necessary.

There is undoubtedly need for an educative campaign to disabuse the public of the impression that the cost of electricity generated by water power must be very low because the water costs little or nothing. Companies who now have construction work going on are in a position of peculiar advantage to carry

SUCCESSFUL HANDLING OF THE TEREDO-LIMNORIA PROBLEM

The inroads of the teredo limnoria wherever piles or other wood structures are reached by salt water have become a serious problem to many western power companies where power lines or electric railways come in contact with coast or bay waters. The Puget Sound Power and Light Company, who have had much trouble with these pests in connection with a trestle of some length used by their interurban lines near Bellingham, Wash., have recently had great success in reinforcing the damaged piles and preventing further inroads through the use of the cement gun. The appearance of the piles before and after treatment is here clearly shown, as well as the simple method of applying the cement.





WESTWARD THE COURSE OF EMPIRE

Since the first census was taken in 1790, each ten-year period has shown the center of population for the United States moving steadily westward, as here indicated by the successive dates. The official center for 1920 has not yet been announced, but an informal calculation shows that this point now lies almost directly south of Chicago. The states west of the Rocky Mountains show an average increase of 39.1% over their population figures for 1910, while the nation as a whole in 1920 was only 14.9% larger than it was at that period. In other words, the West is not only the great producer of raw materials, but is becoming more and more a power in the nation's markets, a fact which has played an important part in the steady industrial development which has kept pace with population increase.

out such educative work. The sight of the tremendous engineering activity necessary to build a dam or construct a power house is a very impressive lesson in the initial expenditure upon which an interest return must later be earned. The completed structure grips the imagination in no such way—but in the absence of active construction work, it would be of value to encourage the familiarity of the public with the extent of the company's properties and structures, which will not only help in the sale of bonds but will lay a foundation of respect for the extent of the investment involved and will spread a more general realization of the costs back of rate charges. This element is an intangible one, but should not be overlooked in planning advertising and otherwise discussing matters relative to public relations.

During the war soldiers returning to the front from the hospitals would show their spirit when one of them would call out, "Are we downhearted?" and from each and every one would come a roar of "No!" and a long cheer. Shoving up toward the fields of horror from the peace and quiet of a hospital ward, knowing only too well the suffering and privations in store for them, these men still had the unshaken faith in themselves and their

cause which enabled them to keep up a cheerful spirit.

The business world in general is going back to battle after three years of order filling; is going back to face keen competition and a general cutting of prices to maintain business. The central stations have had a hard time these past three years petitioning regulatory bodies and fighting the natural reluctance of the public in their efforts to get rate increases which would enable them to meet rising costs of labor and material, and to pay their security owners a fair rate of interest on money borrowed. While other commodities rose from fifty per cent to as high as four hundred per cent the rates of power companies rose an average of fifteen per cent. Now in a period of retrenchment there are some who are clamoring for a reduction in power rates first, probably reading only one part of their Bible, " * * * the last shall be first." Among this group there is a tendency to call the commissions which in the past have protected them, the hirelings of the power companies. If all commodities reach their pre-war level the worst that faces the industry is a drop of fifteen per cent as against the enormous fall of some others.

"Are we downhearted?" We have the same faith in the industry and in the cause of the right, and we can afford to shout "No!" and give a long cheer.

The modern tendency in the operation of central steam stations is toward higher steam pressure and higher superheat, as brought out by C. H. Delany and W. F. Durand in *Electrical World* May 15, 1920. Here it was shown that, with steam at 200 lb. pressure and 200 deg. superheat compared with steam at 300 lb. pressure and 166 deg. superheat, a very interesting situation develops, especially since both of these pressure and superheat conditions give the same actual temperature of the superheated steam as 588 deg. F. In such a case it may be observed that while the quantity of heat present in the initial steam in the two cases is practically the same, the heat utilized in the case of steam energy at 300 lb. pressure is about 4% more than in the case of 200 lb. pressure steam. In actual practice these figures would be slightly modified by difference in efficiency of the prime mover under the two different conditions. However, with turbines properly designed for the conditions under which they are to operate, this difference would be small and may be neglected in any practical discussion of the subject.

Already this trend toward higher pressure development is to be seen on the Pacific Coast, as brought out in the article above referred to. Within the last two or three years power plants have been built in this section of the country for boiler pressures of 250 lb., while in the Eastern states plants are already in operation at 300 lb. pressure and pressures even as high as 500 lb. are being talked of as possibilities. The maximum limit to pressures and superheat is determined at the present time by the temperatures that the materials of construction will stand. With present steels 700 deg. F. is about the limit. This limit would be reached at 500 lb. pressure and 230 deg. of superheat. The pressure is also limited commercially by the extra cost involved, as it is possible that in some circumstances the fixed charges on the extra investment required for the high pressure apparatus may neutralize the saving effected.

However, the trend toward higher pressures and higher superheat is the inevitable urge of economic development and to this careful investigation, both in design and operation looking toward higher pressures and higher superheat, engineers and executives may well give ever-increasing attention.

The electric manufacturers of the country look to the power men to keep them in touch with the needs of the industry. Where apparatus has proved inadequate, and what new instruments or materials are required—these complaints or appeals, brought out during the papers and discussions of every electrical convention, in large measure direct the channels of research for the coming year. The manufacturers themselves, of course, are always on the lookout for improvements in their equipment and many of the important advances in modern practice are to be credited to their initiative. The engineer in the field and the manager who is planning for extensions and economies, however, are the ones most closely in touch with needs and most capable of foreseeing new possibilities. An example of the practical results to be obtained through such cooperation is to be seen in the development of the oil field motor which was worked out simultaneously by two national manufacturers to meet a California situation whose needs were first pointed out by a power company manager on the lookout for a new market for his output.

Among the needs of the moment which have been recently voiced by the power industry are the development of an oil switch adapted to the larger capacities of modern central stations, and a standardized method of figuring the rupturing capacity of such switches, together with the development of outdoor metering equipment suitable for use by saw mills, irrigating plants and in similar exposed situations common in western experience. It is significant that the manufacturers are already at work in the solution of these problems.

Would not a similar coordination of effort bring about equally satisfactory results in fields other than those of strictly electrical interest? Complete records are not so often kept on the hydraulic side of the generator and in consequence the engineer is not in a position so definitely to analyze his needs in his field. More care in keeping such data would perhaps be productive of effective research work on the part of the manufacturer which would solve some of the problems now embarrassing work in this field. Men of the power industry should not overlook their responsibility in pointing out the way in which progress can most advantageously advance.

The Past Year

The Past Year

In the pages of this issue of the Journal of Electricity an attempt has been made to sum up those events of the past year which have stood out in the electrical industry in the West. These two inches of space we have reserved to talk about ourselves and the work we have done. In the twenty-four issues of 1920 we have tried to record the achievements of the year, to point the way toward better business methods, to suggest the solution of engineering and allied problems, and to work toward the common end which is the welfare of the industry. As this year is drawing to a close we cannot help but feel that we have done our part in the building up of the industry in the past twelve months, that we have made new friends and kept our old ones, and while in some part "we have done those things which we ought not to have done, and left undone those things which we ought to have done" our spirit has always been to do our best. During the next year we hope to profit by the experience of the past and to be of even greater service to our readers by reporting not only the progress made within the industry but also the progress of electricity as a means of increasing production and a labor saving element in all industry, on the farm and in the home.

The Power Situation in California—1920

BY H. G. BUTLER

(The rapidly growing load, especially agricultural and industrial, in California makes the power supply one of the most important concerns in the state. The following survey of the 1920 power situation, with an outline of the projected new sources of supply, is by the Power Administrator of the California State Railroad Commission.—The Editor.)

With the present installation of hydroelectric plants belonging to the interconnected companies, forming a continuous chain from a point fifty miles north of the California-Oregon line to Mexico and serving the industrial and agricultural centers in the Sacramento and the San Joaquin valleys, Southern California, and the coast, the difference in output between a normal year and a dry year amounts to about 350,000,000 kw-hr., approximately 54,000 hp. continuously, 15 per cent of the total output of these plants during 1919.

To generate this energy by steam would take 1,700,000 barrels of oil costing upwards of \$3,000,000. This, in itself, would make a dry year rather a serious matter to the power companies and their consumers; but it is much more serious when load conditions and the lack of new developments require the operation of the steam plants practically to full capacity for six months even in a normal year, and as a consequence the difference between the energy output during normal and dry years for those months roughly measures the extent to which consumers will be deprived of power to pump water for irrigation, to run street cars, and to carry on the thousand and one activities dependent on electricity.

Deficient Precipitation

These conditions obtained in the late winter and early spring of 1920. By the middle of February the snow at the high elevations was so scanty it appeared inevitable that every company in the state dependent on hydroelectric power would be unable to carry its own load during the summer. The San Joaquin Light & Power Corporation was even then

refusing new business, was shifting load from day to night to increase the load factor on its steam plants, and was taking off load when it could be done without serious injury to the consumer.

As the spring advanced, the outlook for the season became brighter. In the water sheds of the southern group (the San Joaquin Light & Power Corporation and the companies south) late storms brought the precipitation to a point approaching normal, and three additional generating plants under construction were so far advanced that their completion during the summer could be depended upon. In the north (Sierra and San Francisco Power Company and companies north to the California-Oregon line) May arrived with the precipitation farther below normal than at any time since the Weather Bureau records have been kept, but still much better than could have been anticipated three months before.

To meet the situation in the south, load was shifted from day to night during the months of April, May, and June, and new business was taken on only when it was strictly essential. Early in July the San Joaquin Light & Power Corporation completed a 17,000-hp. steam plant at Bakersfield, the city of Los Angeles brought in 23,000 hp. in a new hydroelectric plant, and the 40,000-hp. Kerckhoff plant of the San Joaquin Light & Power Corporation was nearly ready to be put in service. This new power more than made up the shortage, and on July 14 all the restrictions which had been imposed on the southern companies were entirely removed. It was still necessary for them to follow a priority

ELECTRIC PLANTS UNDER CONSTRUCTION IN CALIFORNIA

Company	Capacity in Kw.	Name and Location	Expected Date of Completion	Type
Great Western Power Company	40,000	Caribou: Feather River (2 units)	April, 1921	Hydro
Pacific Gas & Electric Company	12,500	Oakland	January, 1921	Steam
	6,100	Hat Creek, No. 1	April, 1921	Hydro
	8,200	Hat Creek, No. 2	April, 1921	"
	44,300	Fall River	March, 1922	"
	7,500	Spring Gap: Stanislaus River	July, 1921	"
City of San Francisco	49,500	Moccasin Creek (3 units)	January, 1923	"
Southern California Edison Co.	16,500	Big Creek No. 2: 3d unit	December, 1920	"
	30,000	Kern River No. 3	February, 1921 (1st unit)	"
	22,500	Big Creek No. 8	August, 1921	"
San Joaquin Light & Power Corp.	12,500	Midway	April, 1921	Steam (gas fuel)
	8,250	Kern River	July, 1921	Hydro
Southern Sierras Power Co.	2,500	Owens Auxiliary	February, 1921	"
	10,000	Levinig Creek	October, 1922	"
Los Angeles Gas & Electric Corp.	10,000	Los Angeles (limited to 7500 kw. account of boilers)	January, 1921	Steam
City of Los Angeles	7,000	San Fernando	January, 1921	Hydro
	2,500	Franklin Canyon	January, 1921	"
Total	289,850			

list in connecting new consumers, and for several months longer those who had their own steam or gasoline plants were refused electric service.

Demands of the Rice Industry in the North

In the north the first move to meet the shortage was made as early as March. The high price of rice for the past three years had encouraged farmers in the Sacramento Valley greatly to increase their acreage for this year, and early estimates indicated that it would be doubled. A large portion of the rice crop is raised by water secured by electric pumping from the Sacramento river and from wells. The load comes on in May and lasts generally for one hundred days—just the time when the stream flows are lowest and the power companies are least able to handle it.

In 1919 the rice industry in the Sacramento valley consumed nearly 37,000,000 kw-hr., and the prospect of furnishing twice that amount of energy for 1920, in the face of existing power conditions, was alarming. Warnings were therefore sent out that the power situation would probably require a reduction in the use of power as against 1919, and growers were urged to reduce their acreage rather than increase it, to make all possible arrangements to conserve water, and to install equipment which would make them independent of the power supply. These warnings were continued until planting time, during the last few weeks in conjunction with the Water Conference Committee organized to see that the best use was made of the water of the Sacramento river which was threatened with depletion by the unusual demand of the rice growers at a time of record-breaking low flow. As a result the acreage planted, although greater than in 1919, was much less than originally contemplated; better use was made of the water, and some 10,000 hp. was installed by the rice growers to care for their own load. Three installations of steam-electric plants totaling 4,000 hp. were made. The rest was in gasoline and Diesel engines.

Restrictions in Northern California

In May, during the night hours, the steam plants were not being worked to capacity, and there was considerable excess power in the hydroelectric plants. In order to utilize this excess, letters were sent to all large users of power asking them to change their hours of operation and make their heaviest demands come after seven p.m. Through the County Farm Advisors the same word was sent to farmers. The result of these requests for shifting load was not all that could have been desired, and later in the month power users, agricultural and others, were required to make this change in their method of operation.

The weather during May and June was cold, and as a result the evaporation of water in the reservoirs and ditches was less than normal and the snow at the higher elevation did not melt as fast as usual. For that reason at the end of June the streams were carrying more water than had been estimated.

Early in August the rate at which the water in the reservoirs was being exhausted, the shrinkage in the flow of the streams, and the breakdown of two

or three important steam units which had been carrying continuous overloads for weeks, made it necessary to put into effect far-reaching restrictions on the use of electric power. Sign and display lighting was eliminated five days in the week, street lighting was reduced to a minimum consistent with public safety, street railroads and all other industries, except agriculture, were put on power rations approximating 80 per cent of their normal supply. Agriculture, under the advice and direction of five members of the United States Department of Agriculture and the University of California, who volunteered their services during the crisis, was allotted power in amounts varying from 100 per cent of normal to zero, depending on the use and locality. New business except lighting was almost entirely refused.

Conservation of Water Supply

Before the restrictions were imposed steps were taken to conserve the supply of storage water in power reservoirs, and to augment the sources of supply.

During several weeks in the summer the draught from power reservoirs is governed by irrigation and not by power requirements. The result is that the load factors on the steam plants are lowered and their possible consequent output reduced—practically amounting in times of shortage to a loss of energy. This year engineers were stationed in the irrigated sections below the principal reservoirs to see to it that no water was released for irrigation purposes unless it was absolutely needed. By doing this, and by taking advantage of the diversities in the irrigation requirements between different sections, as well as the diversities in load between companies, it was possible to use the water for the dual purpose of power and irrigation to the best advantage.

To increase the supply of water several water rights were purchased or rented on tributaries of streams developed for power. Many acres of land in the northern counties were deprived of water for irrigation through such arrangements in order to increase the power output.

Interconnection and Augmented Power

Every effort was made to bring to the consumers, through the power companies, power from other sources which are not ordinarily used. In the first place, every steam generating plant owned or controlled by the power companies was operated regardless of the cost of the output. An interconnection between the San Joaquin Light & Power Corporation and the Pacific Gas & Electric Company was completed, through which some 2,000 hp. was delivered to the northern portion of the state. Arrangements were made so those who had private plants would

DO YOU REMEMBER

—that in 1898 San Francisco ranked third among the cities of the world in the use of electricity per population, based upon figures of central station output?

operate them and reduce their demand on the power companies accordingly. Any excess these plants had was absorbed by the companies. The municipal steam plant of the city of Alameda, the Diesel engine plant of the city of Palo Alto, steam and hydroelectric plants of mining, sugar, lumber and oil companies, electric railroads, irrigation districts, and other industries, all contributed their surplus power to relieve the shortage.

Past Conditions and Future Outlook

If the weather conditions in the fall of 1920 had been similar to 1919 the power shortage would have continued from August, when restrictions were first imposed, until well into the new year. As it was, rains early in October replenished the streams and lightened the load so that the restrictions could be gradually removed, and by the middle of the month conditions were again normal.

The northern portion of the state went through a power shortage in 1918, narrowly missed one in 1919, and suffered again in 1920; fortunately not as

severely as conditions in March indicated, thanks to favorable weather in the late spring and early fall, but still severe enough to have a hampering effect upon industry. The southern portion was on the verge of the shortage in 1918 and 1919 which actually materialized in 1920. The power situation of the state is therefore one which cannot be looked upon in retrospect with any degree of satisfaction. It is more cheerful to look ahead.

There are under construction at the present time seventeen projects which will increase the generating capacity of the state 390,000 hp. Of these fourteen are hydroelectric with a capacity of 340,000 hp. All of them will be in operation by 1923, and probably by that time many more in contemplation will have been started and put in operation. In 1921, unless present plans go far awry, commencing in January one plant after another will be completed until 240,000 hp. has been added to present capacity; a fairly satisfactory guarantee that next year there will be an abundance of power for all consumers both present and prospective.

High Voltage Research Equipment

BY HARRIS J. RYAN

(In the field of electrical research great advances have been made during the past year and much valuable work accomplished. Following is a description of some of the equipment in the high-voltage laboratory at Stanford University where Professor Ryan of the electrical engineering department has been carrying on extensive and productive research work. This work is of especial interest in the West in view of the recent record advances in high voltage transmission.—The Editor.)

The frontispiece of the present issue of the *Journal of Electricity* is a reproduction of a photograph of a high voltage oscillator in action. The discharges to the opposing grounded electrode are 111 inches in length. The length can be authenticated by using a scale made from the fully extended 72-inch folding "pocket rule" that is seen in the photograph hanging from the discharging electrode of the oscillator.

In establishing a high voltage laboratory for university needs this oscillator was developed for the purpose of authenticating routes of discharge produced by impulsing super-voltage through large air columns between opposing electrodes in the clear or about intervening insulators. In so doing the following elements were adopted: a condenser made of thirty common window glass plates with electrodes of light weight sheet tin, 20 by 20 inches, immersed in transformer oil; a primary discharge-interrupter gap between rotating cast-iron wheels similar to the corresponding gap used in Creighton's oscillator, except that an air blast having a velocity-head equivalent to a 5-inch water column has been added; the oscillator, proper.

The primary and high voltage secondary coils of the oscillator are formed and mutually related in their mounting, as may be seen in the photograph. The low voltage primary contains a maximum of 12 turns. They are bare, air-insulated, and form an inverted frustrum of a cone to accomplish close coupling with the low potential portion of the sec-

ondary without overstressing the intervening air. They are made up of No. 0000 B and S G, 7-strand hard drawn copper cable.

Big steps in tuning the oscillator are taken by cutting in or out single turns from the fixed portion of the primary that contains **ten** of the **twelve** turns. The two remaining turns are given a flexible mounting below the rest. Exact tuning is accomplished by moving them up to or down from the fixed turns. When the oscillator is operated "unloaded" as in the photograph, **seven** fixed turns and a certain position of the floating coils will produce exact resonance, i. e., exact equalization of the frequencies of the primary and secondary pendulums. When the oscillator is overloaded by connecting the high voltage terminal of the secondary to 20 feet of 1-inch tubing as a line conductor suspended in the middle from a double 13-unit suspension insulator string and ended with a corona-preventing, 3-foot sphere in tuning it is necessary to add some inductance at any convenient point in the primary circuit. A few turns of conductor 20 inches in diameter suffice for the purpose. The exact number is determined by trial in each case.

An essential feature of the oscillator is the sphere, 4 feet in diameter, that serves as the main terminal and high voltage secondary condenser. It is dimensioned and formed strategically to prevent waste of energy by corona formation. The energy released from the primary condenser must be conserved to apply in the production of the desired dis-

charges; likewise to prevent the air that surrounds the secondary coil from over-stress under all operating conditions. The single layer secondary coil is mounted on a redwood cylinder, 10 inches in diameter and 48 inches long. The coil proper has a net length of 46 inches and contains 1250 turns of No. 24 B and S G double cotton covered magnet wire. The condenser terminal construction is further revealed by the photograph. The greatest depth of air column insulation between the high and low voltage terminals is 39 inches. This suffices because of the structural strategy employed to withstand satisfactorily the voltage required to develop 111-inch discharges through the air between the discharging and opposed grounding electrodes. The form of the electric field from the sphere and secondary coil to the ground is such throughout that ions have to travel virtually at right angles to the field to reach any vital portion of the oscillator. That they cannot do. They are formed by overstress of the air at the discharging electrode and with turbulence are driven violently outward in the direction of the field.

From the dimensions given the capacitance of the primary conductor can be computed. It is charged generally at 15,000 volts, 60 cycles, through some inductance-resistance protectors for the source transformer. One can also compute approximately the inductance of the secondary and its oscillating frequency. From these values after making a fair allowance for losses occurring in the primary gap-discharger the energy delivered to the secondary is revealed and the value of the secondary current can be calculated. The voltage generated when flashes are not permitted to reduce the energy present in the secondary pendulum is then given by the relation:

$$e = 2\pi fLi$$

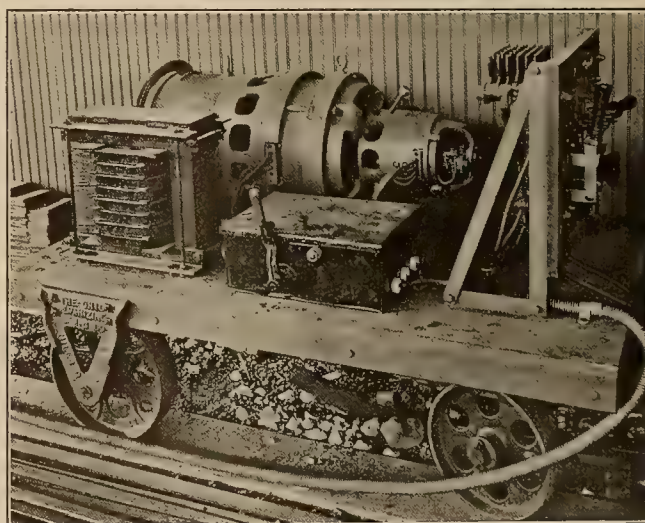
As the flashes are allowed to develop, the oscillating energy in the secondary is diminished with a corresponding diminution of voltage developed. After making reasonable allowances for the losses specified above, the residual energy thrown into the secondary pendulum is thus estimated to develop about 2,500,000 volts, effective, when no flashes are formed. Flashes are always allowed to develop, for the insulating air columns, at their best, can not withstand the stress produced by such high voltage "to ground." The voltage is, therefore, always limited by the amount of energy expended in the flashes or discharges that are formed. The action automatically limits the length of flashovers that can be produced. Such length in the present oscillator varies between the limits of 8 to 10 feet. At 10 feet, assuming an impulse ratio of 1.5 over corresponding sustained 60 cycle action and 10,000 volts per inch for the latter, the voltage required to produce a 111-inch flash-over is estimated to be 1,660,000 volts, effective, which is about what one would expect from the values and relations given above. It is a reasonable assumption, therefore, that the value of the voltage which produced the discharges and which appear in the photograph was not far from 1,500,000 volts, effective, to ground.

RECENT DEVELOPMENT IN MACHINES FOR ELECTRIC ARC WELDING

In the Journal of Electricity of March 1, 1919, there was an article describing the types of machines then in existence for use in producing the arc in arc welding operations. Since that time, the whole country has seemed to take a greater interest in arc welding, and most of the manufacturers have made improvements in their standard machines. Some have found it possible to adopt a more compact form, and yet maintain the efficiency of the set, while others have brought forward new types of machines.

While all agree that the operator is the most essential factor in arc welding, and must bear the greatest responsibility for its success or failure, yet it is also as universally agreed that the stability and the quality of the arc must be maintained.

There still exists differences of opinion as to the best method of producing the arc, but from the machines put on the market since the article in the Journal of March, 1919, was written, would seem to indicate that the variable voltage type of machine is gaining in prominence. When the said article was



A self-contained one-man arc welding outfit which marked a distinct advance over earlier types

written it mentioned one known type of variable voltage set, at that time actually on the market, and two types which were being developed. Today there are four manufacturers manufacturing this type of machine; the first and the longest in the field is the Lincoln Electric Company of Cleveland, Ohio, with several varieties of machines to meet varying conditions; the second in the field is the U. S. Light and Heat Corporation of Niagara Falls, N. Y., who also make a line of similar machines; the General Electric Company and the Westinghouse Electric & Manufacturing Company have also a line of this type of machine included in their standard equipment.

DO YOU REMEMBER

—the incorporation of the first central station in San Francisco by G. H. Roe on June 30, 1879? The first plant was a wooden building which burned down later and machinery was stopped at midnight.

Early Records in Western Power Development



The old San Antonio plant of the San Antonio Light & Power Company, at Pomona, territory now served by the Southern California Edison Company. This plant, built in 1891, was the source of power for the first long distance transmission line in the world—28 miles at 10,000 volts.



Plant No. 1 of the San Joaquin Light & Power Corporation, 1450-kw. capacity, was placed in operation in 1896 with a static head of 1410 ft., the highest head then in America. The thirty-five mile transmission line, carrying power at 11,000 volts into Fresno, was the longest then in existence.



Viewing the lower Spokane Falls, Washington, in 1884 previous to the power development. The old Spokane Falls plant, completed two years later by the Washington Water Power Company, was built on this site which is now in the center of the city of Spokane. The first hydroelectric plant of any size built to supply a city.



Rome power house, on the South Yuba river, built in 1895 by the Nevada County Electric Power Company, later absorbed by the Pacific Gas & Electric Company. The plant had two 240-kw. units operating under a 190-ft. head, and delivering 550 hp. to Nevada City over a 5000-volt line.



An early hydroelectric plant at Oregon City, on the system of the Portland Railway, Light & Power Company. The plant was tied in with another and used a system of bells for starting the generators simultaneously. It is still in existence, generating at 30 cycles as formerly, but converting to sixty.

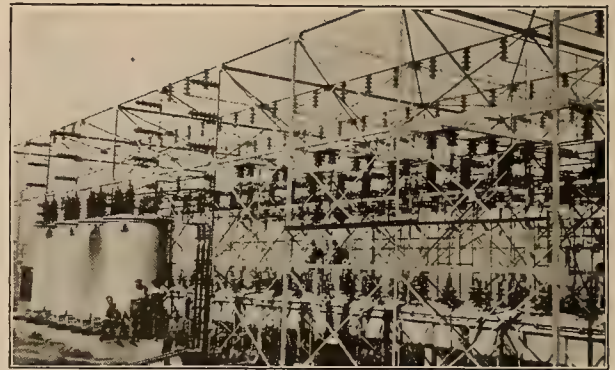
Plans for the Electrical Future



The site of the proposed dam to be constructed across the Colorado River as a part of the hydroelectric development of the Southwestern Industrial Company. The dam will be 120 ft. high, backing the water up for fifty-six miles, and storing 1,500,000 acre-feet of water. The ultimate installation will be 10 units of 12,500-kva. each, generating 140,000 hp.



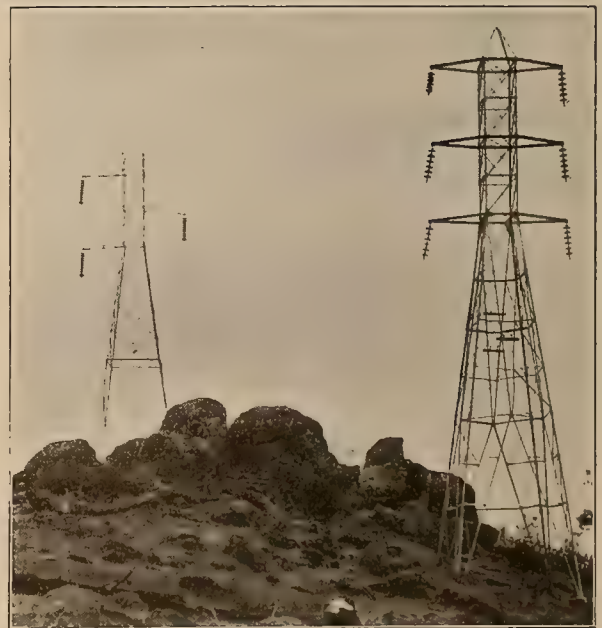
Pouring the foundation for the draft tube at Hat Creek Power House No. 1, on the Pacific Gas & Electric Company's Pit River project. The ultimate development will be about 400,000 hp., power being transmitted 220 miles at 220,000 volts.



View of the recently constructed 60,000-volt switch rack of the Vestal Substation, Southern California Edison Company, near Porterville, California. The picture shows also the 5,000-kva. transformer for the 60-cycle end of the frequency changer.



General view of Camp No. 13 on the Kings River project of the San Joaquin Light & Power Corporation, looking down the North Fork. This project will have an ultimate output of between 270,000 and 300,000 hp. and will cost about \$55,000,000.



On the right is shown the double circuit, 110,000-volt Las Plumas line of the Great Western Power Company, and on the left a valley type tower on the single circuit, 165,000-volt Caribou line which is to break the present world's record, transmitting power at 165,000 volts.

Fuels of the Pacific Coast

BY C. H. DELANY

(The benefits of the power shortage might be hard to point out to the engineer in charge of hydroelectric operation but to the engineer in charge of steam generating plants the power shortage meant operation under extremely difficult conditions which gave him an opportunity to study overload conditions for a prolonged period. The increased cost of fuel oil made imperative the search for greater economies in the use of this fuel and for new fuels. The outstanding features of the fuel situation on the Pacific Coast for the past year are outlined in the following article by the assistant engineer of operations of the Pacific Gas and Electric Company.—The Editor.)

The outstanding feature of the fuel situation on the Pacific Coast, during the year 1920, has been the growing scarcity and increasing price of fuel oil. The problem would be a simple matter were coal as plentiful on the Pacific Coast as it is in the eastern and middle western states. In California, unfortunately, coal is much more scarce than oil. Except for three or four mines containing a poor quality of lignite, none of which are now in commercial operation, there is no domestic coal available. All coal used in the state must therefore be transported from a distance, with the result that the cost of coal delivered at the plant is excessive.

With the scarcity of these two fuels staring us in the face, it is not surprising that the engineers of the Pacific Coast are turning their attention more and more to the unending supply of "white coal" that is always available in the mountains. Thus we find greater activity than ever before in hydroelectric developments. The power companies contemplate generating larger and larger proportions of their output by water power, and manufacturing plants are turning more and more to power companies for the necessary energy to keep their wheels turning. There are many factories, however, which require steam or heat in some form in their processes and they must burn fuel to produce it, so that even if the hydroelectric developments succeed in catching up with the demand for power, there will always be an independent demand for fuel.

Greater Efficiency in Oil Burning Demanded

The scarcity of oil, besides arousing interest in other kinds of fuel, has stimulated in a marked degree the demand for more efficient methods of burning oil. Interest in efficient operation was given added zest by the recent power shortage, when the quantity of oil burned for electric generation was greater than ever before. This led to the forcing of boiler plants to a maximum, and the necessity of securing good efficiency even at high overloads, was marked.

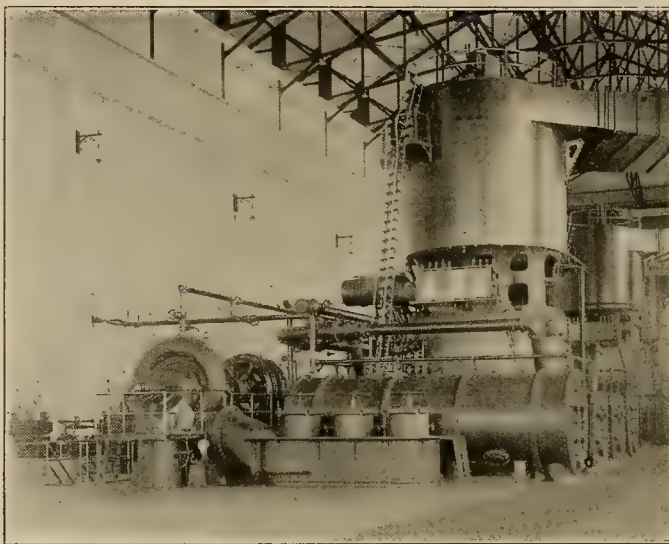
Perhaps the greatest development in oil burning during the year 1920 has been the introduction into stationary practice of the method of atomizing the oil that has proved so successful in marine practice, namely, mechanical atomization.

It has been found that in a furnace of a given size, a greater quantity of oil can be burned when mechanical atomization is used, than when the atomizing is done by steam. The natural result of this is that, for a boiler with a given furnace volume, it is possible with mechanical atomization to burn larger quantities of oil in the furnace proper; or, in other words, complete combustion may be obtained, even at high capacities, before the gases come in contact with the boiler tubes. With steam atomization this is also true at normal rating, but at high capacities complete combustion is not obtained before the gases are chilled by contact with the boiler tubes; so that, while the efficiency at normal rating may be as high as 81 or 82 per cent, it gradually falls off as the capacity increases, dropping to about 74 per cent at 200 per cent rating.

With mechanical atomization, on the other hand, it has been found by tests that it is possible to maintain efficiencies over 80 per cent clear up to 300 per cent of the boiler rating. It thus appears that a real advance in the art of oil burning in stationary plants has been made during the past year.

Undeveloped Coal Deposits

Coal is used quite extensively in the Northwest, where there are considerable deposits of bituminous and sub-bituminous coal and lignite. While much of the coal available is of a fairly good quality, there are much larger deposits of very low grade coal or lignite, not yet developed. It is difficult to burn these low grade coals on any form of stoker and secure good efficiency. When burned in the pulverized form, however, the efficiency obtained is almost as high as with the better grades of coal. For this reason, pulverized coal has made good progress in the Northwest, where coals containing as high as



"A friend in need is a friend indeed" might aptly be applied to the steam standby plants which must be ready at all times to pick up the load dropped by the hydro plants in time of trouble. The extent to which these plants have been forced during the past three years, due to the shortage of water and the increased demand for power, is unprecedented. The illustration shows two of the big turbines in the Long Beach plant of the Southern California Edison Company.

30 to 35 per cent ash have been successfully burned. Efficiencies as high as 75 per cent have been obtained, and where the furnace is of ample proportions it is possible to operate up to 200 per cent of the boiler's rating.

Natural Gas

Natural gas, which is superior to all other fuels as regards flexibility and ease of operation, occurs extensively in the California oil fields. The San Joaquin Light & Power Corporation is operating a steam plant in Bakersfield fired by natural gas, which is piped into town, and is building an additional plant near the oil fields where the supply of gas is abundant. The heating value of natural gas runs from 930 to 1040 B.t.u. per cu. ft., so that one barrel of oil is equivalent to about 6,000 cu. ft. of gas. If the gas can be purchased for, say, 14 cents per 1,000 cu. ft., it is equivalent to oil at 84 cents per barrel. Unfortunately natural gas is not available for power purposes in the large industrial centers. If it is brought into a large city, it immediately becomes so valuable for domestic uses as to place it out of reach of the steam plants.

Refuse As Fuel

Refuse from certain industrial establishments is used as fuel wherever it is available in sufficient quantities, and has high enough heat value to warrant the installation of the necessary equipment. By the use of refuse as fuel not only is the purchasing of new fuel saved, but also the expense of disposing of the refuse is eliminated.

The refuse from oil refineries is by far the most important of these fuels, for it is possible to consider fuel oil in this category. Fuel oil is the product that remains after the more valuable lighter oils, such as gasoline and kerosene, are distilled off from the crude petroleum. Indeed the present scarcity of fuel oil is due in part to the progress made by the oil refineries in methods of producing gasoline, and the recovery of greater and greater proportions of the crude petroleum in the manufacture of this commodity. In fact, some of the most up-to-date refineries are now producing a residue entirely different from fuel oil, but which will undoubtedly become a valuable fuel when suitable storing and burning methods have been evolved.

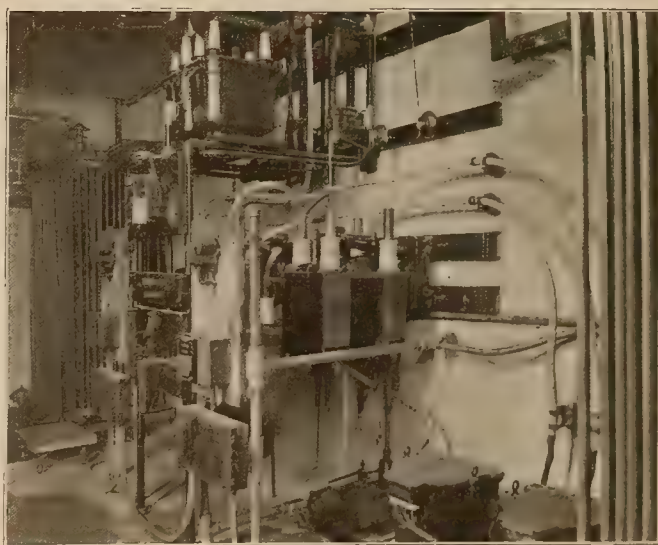
Saw mill refuse, consisting of sawdust, chips and small blocks of wood, is the universal fuel in the lumber industry. Most lumber mills produce more of this fuel than is required for their own boilers, and it has heretofore been the custom to destroy the surplus in large burners. Where the lumber mill is in proximity to other industries, this fuel can be distributed and becomes a valuable source of cheap fuel. Public utilities in Portland, Oregon, are using sawmill refuse, hogged fuel, for the generation of electric power. The fuel contains a great deal of water, 35 or 40 per cent, but it burns satisfactorily in Dutch oven furnaces of large volume, being fed to the furnaces by conveyors through openings in the furnace roof. The fuel piles up on the grates in conical form, and burns around the edges where the fuel bed is thin, while the main body of the cone is

drying out. Owing to its bulk, sawmill refuse is difficult to transport and to store, so that its use is limited to plants in the vicinity of lumber mills.

Tan bark, by which is meant the spent tan or refuse remaining after the tannin has been extracted from the bark in the leaching process, is a fuel used for steaming purposes in tanneries. It is finer and contains more moisture than sawmill refuse, usually running about 65 per cent moisture, and is therefore more difficult to burn. It can be burned with good results in a properly designed Dutch oven, provided with strong induced draft. As tanneries require a great deal of steam in their various processes, the tan bark available is not sufficient fuel for their own needs, and consequently there is none on the market for other users of fuel.

Another fuel that is very limited in its supply is the refuse from oil gas works, commonly called "lamp black." This is a fuel of high heating value, containing over 14,000 B.t.u. per pound dry and less than 2 per cent ash, but as it is removed from the gas generators in washers, it becomes saturated with water, and on reaching the fire room, it contains from 50 to 70 per cent of moisture. This fuel contains a good deal of tar, and is sticky and difficult to handle. It is fired by hand and burns brightly and easily, notwithstanding the high water content. Best results are obtained with a thick fire and extra large grate surface is necessary if the boilers are to be operated at high capacity.

TRANSFORMER FOR BRASS FURNACES



The above is a corner of the transformer vault in the foundry of the Oregon Brass Works, Portland, Oregon. The 300-kva. transformer supplies current to the 2000-lb. brass furnace. The two small transformers in the foreground supply three-phase current for the rocking motors.

DO YOU REMEMBER

—that in 1895 long distance transmission was regarded as an experiment and a long treatise appeared in one of the technical magazines questioning the possibility of ever locating the plant at a distance from the consuming market?

New Transmission Line Construction in 1920

BY H. A. BARRE

(Transmission of power at 220,000 volts is not yet an accomplished fact, but it has been definitely nearer during the past year. The following article reviewing some recent transmission achievements is by the electrical engineer for the Southern California Edison Company.—The Editor.)

The most interesting feature of transmission line development during the year 1920 has not yet reached the stage at which it would ordinarily be considered an achievement, and thus be properly included in the Retrospection Number of this Journal. Nevertheless it is of such great importance that it should be given a prominent place in our consideration of the year's work.

Rapid Growth of Ideas

Slightly more than a year ago when Messrs. Sorensen, Cox and Armstrong presented their paper on the California 220,000-volt bus at the Pacific Coast Convention of the A. I. E. E., the subject was not given very serious consideration by many of the delegates. Today plans are well under way for the actual construction of the greater part of this bus, the northern and southern ends, and the gap between these two sections is actually bridged by large capacity inter-connections of lower voltage. Some of the delegates who were least inclined to give favorable consideration to the 220,000-volt bus idea were representatives of the companies which are now constructing these lines, and are parties to the inter-connections referred to. This is of interest only to show how the thoughts and the plans of our Pacific Coast engineers have advanced during the past year.

This advance has been forced upon us by necessity. In the case of the Southern California Edison Company, the Big Creek lines at 150,000 volts will be loaded to the maximum limit of approximately 120,000 kw. by the spring of 1922. After that it will be necessary to provide more transmission capacity before additional generating units can be put into service at Big Creek. The capacity can be doubled, either by constructing two more 150,000-volt lines, or by raising the voltage on the present two lines to 220,000 volts. The first plan would cost from \$2,000,000 to \$15,000,000, while the second would cost from \$2,000,000 to \$3,000,000.

Experiments on Insulation

Plans for increasing the voltage of the present lines to 220,000 volts are rapidly taking form. The work of Professor Ryan at Stanford University on the voltage distribution and flashover characteristics of long strings of insulators has shown beyond a doubt that line insulation for voltages of this magnitude can be provided successfully by the use of the standard insulators of today. Plans for energizing a 30-mile section of one of the Big Creek lines have been made. This section will be insulated with standard ten-inch cap and pin suspension insulators arranged in various forms to suit the clearance conditions required at different towers and different positions on the towers. This section of line will be energized through a bank of three 4500-kva. trans-

formers, connected in delta on the 60,000-volt side and star on the high tension side, which will give a possible variation of line voltage from 206,000 to 272,000 volts. While it is realized that this short section of line, open at one end and carrying no load, will not show operating characteristics the same as those of a long line over which power is being transmitted, it is hoped that some information in regard to proper insulation will be obtained. After this experiment has been completed, the next step will be to convert one of the circuits for commercial operation at 220,000 volts.

The equipment for the first unit of the Big Creek Power House No. 8 has been purchased with characteristics suitable for either 150,000 or 220,000-volt operation. This equipment will be installed by the middle of 1921. The transmission voltage will not be raised to 220,000 volts until one or two years later.

The changes necessary at the terminal stations present a large problem in themselves. Various schemes for accomplishing this are now before the manufacturers for their consideration. The manufacturers are confident of being able to make successful apparatus for 220,000-volt operation. The question is, which of various ways of changing from 150,000-volt operation to 220,000-volt operation is the best.

The actual carrying out of these plans will be accomplished during the next one or two years.

New 60,000-Volt Construction

There have been no particularly striking achievements in actual construction of transmission lines on the Southern California Edison system during the year. Practically all the transmission line construction has been on 60,000-volt lines.

The most important line constructed is the Kern No. 3-Vestal line which connected the new Kern No. 3 Plant of 32,000-kw. capacity with the Big Creek lines at Vestal, a new substation built for this purpose, and for the further purpose of tying the 50-cycle system of the Southern California Edison Company to the 60-cycle Mt. Whitney system of that same company, and the 60-cycle system of the San Joaquin Light & Power Corporation. Vestal is almost due west from Kern No. 3 and is between the towns of Richgrove and Ducor. The line is nominally a 60,000-volt line, but the actual voltage will be approximately 75,000 volts at the Kern No. 3 end and 70,000 volts at the Vestal end. It consists of approximately 37 miles of single steel tower line carrying two circuits, and six miles of double wood pole lines, each carrying a single circuit. The conductors are of 4/0 copper and a steel ground wire is carried above the conductors the entire 43 miles. The dead end insu-

lators consist of six 10-inch cap and pin suspension units and the suspension insulators consist of five units of the same type. This line passes over the Greenhorn Mountain at an elevation of 6200 feet, the Kern No. 3 and the Vestal ends being at elevations of 2600 feet and 450 feet respectively.

Approximately 86 miles of the so-called Mt. Whitney loop has been replaced with an entirely new 60,000-volt line this year. Previously this loop was a 30,000-volt line, but the rapidly increasing load made it necessary to change all but the northern end of it to 60,000 volts. The new line makes a 60,000-volt loop to which the remaining portion of the old 30,000-volt loop is connected by 60,000/30,000-volt transformers at Lindsay and Tulare.

There are two points of interest in regard to the construction of this line. The first is the ease of framing the pole tops. No gains were cut, thus reducing the work on the pole itself to the boring of holes for two through bolts.

A Successful Hole-Boring Machine

The second point of interest is the manner of digging the holes. A hole-boring machine was purchased and has proved very satisfactory. This machine will dig a hole 24 inches in diameter and 8 feet deep, 7 feet of which is through "hard pan," in 13 minutes, and the best time made for a hole of this size where the ground was more favorable, was a little less than two minutes from the time boring was started until the hole was completed. In some cases the "hard pan" has been so hard that a cloud of smoke rose from the hole while the bit was in operation. Three or four holes through material of this type make it necessary to sharpen the bit. This is done by replacing the cutting edges and sharpening the worn ones for subsequent use.

The boring machine is mounted on a turn-table which is bolted to the bed of a five-ton, four-wheel-drive truck, equipped with pneumatic tires and designed for a speed of fifteen miles per hour. The turn-table allows the machine to be swung through approximately 270 degrees, and the tower which carries the augur can be tilted forward or backward to any angle up to 36 degrees from the vertical.

There is a pole-raising derrick mounted on the truck. It is independent of the turn-table, and will operate to the rear of the truck only. The derrick is of 5,000-pound capacity and of sufficient height to handle a 40-foot pole. A derrick of sufficient height to set a 60-foot pole is being designed to replace the present one.

When boring holes only, the outfit is operated by two men, one in the truck cab to handle the truck and the power plant and the other on the ground to control the augur and direct the movements of the truck. Power for all operations is supplied by the truck engine.

In boring a hole the augur is driven down until it is covered with dirt. Then its rotation is stopped and it is pulled out of the hole. Then its rotary movement is started again and the dirt is thrown into a circular pile around the hole. Only in very dry loose dirt has it been found necessary to do any

hand shoveling away from the hole. In places where poles have to be put over fences or across ditches, the derrick has been used to great advantage.

Other Transmission Improvements

Two other 60,000-volt lines of considerable importance which were built during 1920 are the Castaic to Saticoy line, 41 miles long, and the Serman to Long Beach line, 28 miles long. The first of these provides duplicate transmission service to Ventura county and Santa Barbara. The second provides a 60,000-volt connection between the steam plants south of the big load centers and the 60,000-volt lines north of these load centers. In fact, it completes a 60,000-volt loop around the load centers located in and adjacent to the city of Los Angeles. These lines are of standard single circuit pole line construction. In addition to the lines mentioned above, only a few miles of 60,000-volt lines were constructed during the year.

THE SKAGIT RIVER DEVELOPMENT

BY C. F. UHLEN

(The waterpowers of the Northwest are among the most abundant sources of power this side of the Rockies. The Skagit river project, with an ultimate possible development approaching 500,000 hp., is here outlined by the engineer in charge.—The Editor.)

The Pacific Northwest today is in no better position, so far as the shortage of electrical energy is concerned, than is any other part of the United States. Especially is this the case in western Washington, where at the present time it is impossible to obtain electric current from any source in the district, all the steam and hydroelectric plants being loaded to their full capacity and some current being supplied from British Columbia as well as from the Washington Water Power Company at Spokane.

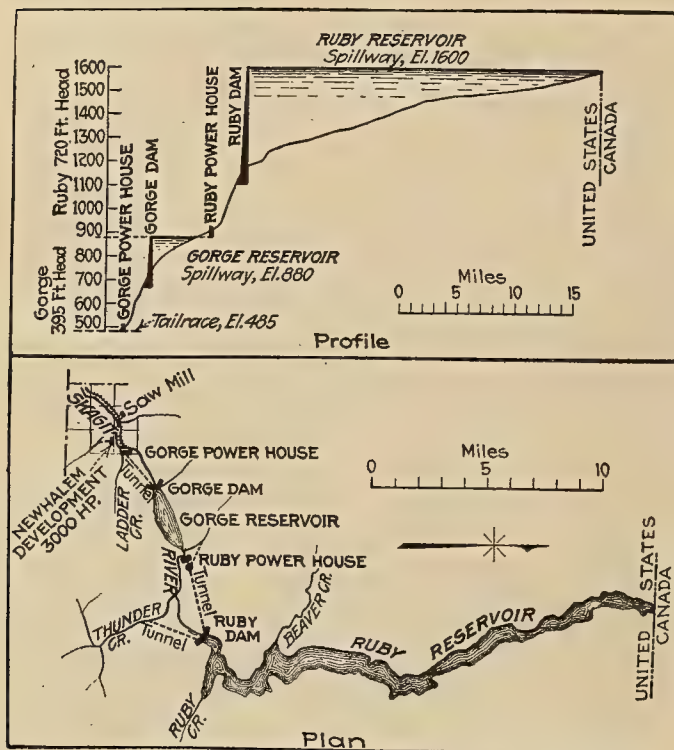
With the object of augmenting the available power supply, Seattle under the supervision of its City Engineer, Mr. A. H. Dimock, has made a complete study and survey of the power possibilities of the surrounding district and has chosen as the most feasible and profitable the development of the Upper Skagit River where an ultimate development of approximately 500,000 hp. can be obtained.

The Skagit River rises in British Columbia, somewhat southerly of a line joining the towns of Hope and Princeton. Flowing first in a general southwesterly and southerly direction, it crosses the International Boundary some seventy miles east of Bellingham, and picks up Ruby Creek at Ruby, some twenty-five miles below the boundary line; continuing southwesterly for another thirty miles, it picks up the Cascade River at Marblemount, the Sauk River at Rockport and the Baker River at Concrete, and thence flows due west for forty miles to the town of Sedro-Woolley. Ten to fifteen miles southwest of

DO YOU REMEMBER

—when transfers were first adopted 25 years ago it was feared they were a failure, owing to the corrupt nature of the passengers who sold them to the newsboys?

Sedro-Woolley, it empties into Puget Sound through the many-mouthed Skagit Delta which comprises the eight-mile stretch of shore line between LaConner and Milltown.



Profile map and plan for the proposed 500,000-hp. development of Upper Skagit River. This river drains an area of more than three thousand square miles of which the Skagit project will develop the entire upper third.

The Skagit River, then, is one hundred and fifty miles long, and drains an area of more than three thousand square miles. Of this three thousand-mile area, the Skagit River Project will develop the entire power of the upper third which lies between two mountain ranges of the Cascades. The main range or divide of the Cascade bounds its catchment area on the east and the range of which Mt. Baker is the best known peak constitutes its western boundary. The run-off of approximately twelve hundred square miles will be utilized through a total fall of approximately eleven hundred feet.

The flow of the Upper Skagit River varies from 800 cu. ft. per sec. at low water to about 50,000 cu. ft. per sec. at high water period, an average flow throughout the past ten years of approximately 3,575 cu. ft. per sec.

It is the intention of the city to utilize ultimately, as nearly as is practicable, the entire flow through the total available head. This will be accomplished by means of two plants, one in the vicinity of Stetattle Creek and one in the vicinity of Ladder Creek, the former having a dam just below the junction of Skagit River and Ruby Creek and the latter having a dam just below the outlet of Gorge Creek.

The waters of Thunder Creek will be utilized by means of a tunnel connecting it with the Ruby Dam, and the waters of Stetattle Creek will also be carried in a tunnel terminating at the surge tower just above the plant.

Extensive diamond drilling has been carried on at the two dam sites showing solid rock of exceptional quality, known as gneiss, at a maximum depth of 110 feet at the Gorge Dam site and at a maximum depth of 30 feet at the Ruby Dam site. These drillings show only a moderate amount of excavation, as the channel in both cases is narrow and has rocky cliffs on both sides extending several hundred feet above the present water surface.

The Ruby Plant, constituting the upper development, will consist of a dam approximately 450 feet in height, a tunnel 17,000 feet in length of about 600 square feet section, and an ultimate installation of six 45,000-kva. units operating under a head varying from 720 feet to 470 feet.

The available capacity of the Ruby Reservoir, whose surface elevation will be 1600 feet above sea level when full, will be approximately 1,000,000 acre-feet and will at times be drawn down to an elevation of 1350, a difference of 250 feet, causing the variation in head at the Ruby Plant above referred to.

The ultimate development of the Gorge Plant will consist of a dam 240 feet in height, two tunnels 11,000 feet in length of 300 square feet area, and six 30,000-kva. units operating under a head of 395 feet.

Not having any available power for construction purposes within a reasonable distance of this development, it was decided to put in a 3,000-hp. hydro-electric plant on Newhalem Creek. This stream has a maximum flow of about 500 cu. ft. per sec. and a minimum flow of 40 cu. ft. per sec. This plant will consist of a small crib dam, 2,720 feet of 5 ft. by 7 ft. tunnel, 700 feet of steel penstock and a 3,000-hp. Pelton Impulse Wheel, direct connected to a 2,500-kva. Westinghouse 6,600-volt generator, and will operate under a head of 500 feet.

Rockport, located on a branch of the Great Northern, is the nearest railroad point and is 23 miles distant from the Gorge Power House. On account of the large tonnage that will be handled, it was decided to build a railroad from Rockport. This railroad is now under construction and will in all probability be completed to the Gorge Plant by March, 1921.

At present all supplies and materials are being transported by three 10-ton Holt Caterpillars and six 5-ton Troy Trailers.

The tunnel for the Newhalem Plant is now being driven and it is hoped to have the plant in operation by next April. A saw mill of 25,000 board feet capacity has been put in operation, which supplies lumber for the temporary camp. This camp will consist of some 75 three-room cottages to be used by the married men, 6 bunk houses of 12 rooms each, capable of housing 24 men each. Also bath houses, commissary, warehouse, hospital, mess house, etc.

The energy will be conveyed at 150,000 volts over a transmission line of about 100 miles in length, with wooden pole structures. It is hoped that energy from the Gorge Plant, which is the first to be developed, can be utilized by the city of Seattle some time during the year 1923.

Pacific Coast N. E. L. A. Committee Activities

(The work of the National Electric Light Association includes the most important group activities of the electrical industry. The following account of the work planned for the coming year by the Pacific Coast Section gives some idea of the constructive program and wide scope of this organization.—The Editor.)

The work of the Pacific Coast Section N. E. L. A. in which is centered the interests of the electrical industry of California and the Pacific Southwest is not by any means confined to convention periods, but continues in the active work of its committees throughout the year. All the major groups of this year's organization are now in full working order and the scope of next year's plans is already well outlined.

The time and place of the next convention of the Pacific Coast Division, N. E. L. A., have been set for May 25, 26 and 27, 1921, at the Hotel Del Monte. The question of program arrangement and the relative importance of business and entertainment features have been under discussion by the executive committee, who are considering the possibility of confining sessions to the morning hours, leaving the afternoons free for recreation. The ad-

justment of finances between the national and coast organizations is the major problem of importance before the executive body, involving as it does not only the regular expenses for the western division, but also the question of traveling expenses of delegates to national committee meetings.

The work of the Public Policy Committee has been carried out under the chairmanship of John A. Britton, vice-president and general manager of the Pacific Gas & Electric Company, and while the committee has not held any meetings it has had a representative present at the meetings of the other committees to assist in all matters dealing with public policy. While this committee during the year stands ready to act in an advisory capacity on subjects of policy

its main duty is to sum up for presentation at the annual convention the progress of the industry as a whole and particularly the central stations. In this annual report recommendations are also made regarding matters of policy which should be adopted—policies which have become obsolete due to a change in conditions, and when necessary a change in policy

to meet new conditions brought about by the growth of the industry, customer ownership of securities or any of the other factors which the industry is continually meeting.

The local public relations committee, which corresponds to the national committee of that name, has been organized this year with R. H. Ballard, vice-president and general manager of the Southern California Edison Company, as chairman and already has held several meetings of importance. The work of the committee has been divided into three subdivisions, S. M. Kennedy heading the work of the sub-committee on public information which is charged with

questions of contact between the press, the public and the power companies, while W. E. Creed is chairman of the group studying company relations with employees. The subject of the relations which should exist between public utilities and regulatory bodies for the time being is left in the hands of the general committee.

The engineering committee under the chairmanship of L. M. Klauber, general superintendent of the San Diego Consolidated Gas and Electric Company, has undertaken a program of important research work. Papers have been planned for discussion at the spring convention along comprehensive lines.

A series of descriptive papers covering the major power developments in the Pacific Coast division that are in progress of construction this year has been suggested, to be prepared by P. M. Downing of the Pacific Gas & Electric Company, H. A. Barre of the Southern California Edison Company, Carl Heinze of the city of Los Angeles, and J. A. Koontz of the Great Western Power Company, each to handle the work of his respective company. An introductory paper prepared by the group with the cooperation of H. G. Butler,

DO YOU REMEMBER

—that the 10,000-volt line of the San Antonio Light and Power Company of Pomona which held the record for high voltage transmission from 1891-1893, was at first declared to be impossible by the Westinghouse Company, who, however, later installed the equipment?



Lee H. Newbert
Pres. Pacific Coast Sec., N. E. L. A.



R. H. Ballard, Chairman,
Public Relations Committee



John A. Britton
Chairman Public Policy Committee



L. M. Klauber
Chairman Engineering Committee

California power administrator, will cover the power necessities and resources of California, both steam and hydraulic, giving approximate costs and quantities involved.

Factors affecting the fixing of rates on a power factor basis are to be considered in a paper in the hands of a committee of which J. P. Jollyman is chairman.

The subject of relays and the problems which have been introduced by large interconnected systems combining steam and hydroelectric stations has been referred for consideration to a group of five engineers, of which E. E. Stauffacher of the Southern California Edison Company is chairman.

A progress report on the development of 220,000-volt transmission is to be made by a committee of nine under J. A. Koontz of the Great Western Power Company.

The preparation of a paper having the nature of a symposium of operating difficulties has been suggested to be carried out by a committee made up of the load dispatchers of the various companies.

A paper by Carl Heinze of the Bureau of Power and Light of Los Angeles will cover the subject of 33,000-volt triplex underground distribution.

The subject of live wire maintenance, as well as the problems connected with electric furnaces, have been referred to the respective committees in charge of these fields and a committee of two has been appointed to investigate and report on the present status of a proposed bill for the licensing of engineers.

In addition to its other work, the engineering committee is keeping closely in touch with developments in the line and safety codes of California through its sub-committees which are active in these fields. The carrying out of insulator testing work is waiting upon the delivery of material which has already been requisitioned, as reported by the sub-committee in charge of this work.

According to the arrangement under the new constitution, all division committees have representatives upon the national committees and an attempt is being made to have an adequate representation at the national meetings, as well as to keep the local committees in touch with the problems being studied through the national groups. Questions of financing and of the selection of delegates were referred to the appropriate committees.

The work of the Publicity Committee, of which Robert Sibley, editor of the Journal of Electricity, is the chairman, has been held back due to the lack of funds which are necessary for the proper functioning of this committee. However, the members of this committee have not been idle but have joined in with the work of the publicity section of the Public Relations Committee in the preparation of material for use by that committee. After the first of the year when



Robert Sibley
Chairman Publicity Committee

funds are available it is the intention of the committee to carry on the work which was started by the last Publicity Committee and make this service of greater benefit to all the members of the Pacific Coast Section.

The commercial committee of which R. E. Fisher, manager of the commercial department of the Pacific Gas & Electric Company, is chairman has planned a comprehensive series of papers as its work for the coming year. For convenience in organizing, the committee has been divided into two parts, A. E. Wollaber being made chairman of the southern section. These have met separately, a joint meeting being planned later to confirm the action taken by the two groups.



R. E. Fisher
Chairman Commercial Committee

Among the subjects selected for study was the electric range. It was felt that due to the increased price of fuel oil and of gas, the present is an especially opportune time for the detailed study of this field and a paper is contemplated covering the following details:

THE ELECTRIC RANGE AND WATER HEATING

- (a) Its value to the central station
- (b) Its value to the contractor-dealer
- (c) Its value to the jobber
- (d) Its value to the manufacturer
- (e) The sale of replacement parts.

"The Convenience Outlet — Its Progress and Future" is to be considered in a report by Garnett Young, which is to be in the nature of a progress-report following the paper read at the last convention. Papers have further been suggested on the following subjects:

- (a) Illumination
- (b) Industrial Heating
- (c) Meeting the Demand for Retail Sales People.

The subject of the simplification of rate schedules is to be taken up by the committee with the object of clearing up the confusion consequent upon the many and varied forms of schedules now in operation. The committee is keeping closely in touch with the work of the California Electrical Cooperative Campaign and with developments along commercial lines such as the course of instruction being offered by the University of California in "How to Sell Electrical Goods."

One of the most significant actions taken by the committee is its expressed intention to carry on the work begun by the commercial committee of the preceding year. It is felt that the recommendations made through the committee in the various papers and reports presented should be definitely followed up—and that the responsibility for action in this respect rests largely with its successor in the work. In consequence, a study is now being made of the reports of last year, with a view to supplementing the work there begun.

The accounting committee, with P. R. Ferguson of the Southern Sierras Power Company as its chairman is engaged in carrying out a program of work which was effectively started by the accounting committee of last year. Active work was carried on after the Pasadena convention by the former committee in the preparation of a uniform classification of accounts for electric corporations which has been submitted to the accounting committee of the Na-



P. R. Ferguson
Chairman Accounting Committee

tional Association for their consideration. The year's committee is continuing their active interest in this field in cooperation with the national committee in the hope that definite action may be taken toward securing the promulgation of a uniform classification by all regulatory bodies, state as well as federal. The question of a uniform monthly earning and expense statement will also be taken up by the committee as part of this year's work, as well as a uniform method of accounting for property replacements, more especially as to the degree of refinement to which charges to property for minor replacements shall be carried.

The membership committee of which R. A. Balzari, San Francisco manager of the industrial division, Westinghouse Electric & Manufacturing Co., is chairman, has been subdivided into working organizations operating in districts throughout California, Arizona and Nevada, with one or more members of the committee in charge of each district. In order to fit in with the requirements of the new constitution of the national body, memberships will



R. A. Balzari
Chairman Membership Committee

be dated as of January 1, 1921, so that the new member may have the benefit of the full year. Details of inducements which may be offered new members and of methods of conducting the membership campaign within the local territories were discussed at length at the initial meeting of the committee and an active program for the coming year was outlined. In order to keep Western members in touch with divisional activities, it has been determined to issue three numbers of the "Electrifier," which has been distributed at regular intervals during previous years, these to be sent to members, one about the first of the year, the second in March and the third immediately preceding the spring convention. It is expected that the membership roll will be materially increased before next May.

THE ELECTRIC FURNACE AS A CENTRAL STATION LOAD

BY ROBERT M. KEENEY

(The following is an extract from a paper presented at the 1920 N. E. L. A. Convention by Robert M. Keeney, director of the department of metallurgical research, Colorado School of Mines.—The Editor.)

In direct contrast with European practice, central stations have practically all the electric furnace load that exists in the United States, there being only a few isolated plants which generate their own power. Ten years ago so little was known of the characteristics of an electric furnace load that few companies cared to have an electric furnace on their lines. Today, with an electric steel furnace in practically every manufacturing city in the country, the load is considered desirable and is much sought.

The most marked increase in the use of central station power in electric furnaces during the past ten years has been in the electric furnace manufacture of steel. From the viewpoint of the average central station, the most important phase of the present development is in the electric furnace production of steel castings. In 1918 there were manufactured 108,296 tons of electric steel castings representing 21.1 per cent of the total production of electric steel.

As a central station load the electric steel furnace is very desirable, although its load factor is low compared with that obtained in some other electric furnace processes. The enormous momentary peaks which are shown on the load curves of some electric steel furnaces are largely due to the method of operation, and the fact that the operator does not know how to handle the furnace properly.

The central station can better the load factor of the electric foundry furnace by making it an object for the customer to operate his furnace 24 hours per day, through the decreased cost per kw-hr. he obtains. Of course this depends on the peaks in the power company's industrial and lighting load, but there is at present a tendency to install small furnaces for 24-hour operation rather than large furnaces for 10-hour operation, and it is to the advantage of both parties that this tendency be encouraged.

It would seem that electric furnaces, particularly smelting furnaces, are operated at their highest efficiency under contracts which provide for a flat charge per kilowatt month, based on the maximum demand, rather than a charge which includes a maximum demand charge and a kw-hr. charge.

In melting steel and non-ferrous metals in electrolytic refining of metals a power cost of one cent per kw-hr. is reasonable. Notwithstanding the slightly greater cost, the demand for the best steel possible for industrial purposes will eventually increase the consumption of electrically produced ferro-alloys.

DO YOU REMEMBER

—twenty-five years ago when the trolley car was displacing the cable line and the public was worried for fear the service would not be so reliable?

Arc Welding Practice

BY J. H. ANDERTON

(Greater flexibility and better control in arc welding are obtained by the use of metal instead of the carbon electrode. The technique of the art, and the machines used, are here discussed by the chief electrical engineer for Stone & Webster, Inc., in the concluding half of his article. The author was a member of the electric welding committee of the Emergency Fleet Corporation.—The Editor.)

Arc welding includes all the systems of autogenous welding in which fusion of the metal is caused by an arc maintained between the surface of the work and an electrode held by the operator. As previously mentioned, earlier work was accomplished by a carbon electrode and using filling metal, which was fused and fed into the joint by the arc. The principal objections to this system are the high temperatures maintained in the work which is liable to cause excessive stresses in the material due to expansion and contraction, oxidation of the exposed metal and the tendency of particles of carbon to get into the weld. This system is used very successfully by Cramp & Sons of Philadelphia for welding knees, angles, rings, deck frames and bulkhead stiffeners for ship structures, replacing very expensive and

difficult smithwork. At Hog Island this same class of work was done by arc welding, using the metal electrode, and approximately thirty thousand pieces were welded in this manner, varying in size from 2 x 3 to 6 x 6 angle. For carbon arc welding, both alternating and direct current may be used. A majority, however, use direct current.

With the metal electrode system, no filling rod is necessary. The metal electrode melts away in the arc and deposits the desired amount of iron or steel in the joint. This system is much more flexible and under better control by the operator than is the carbon arc. The welding can be done by one hand. The temperature conditions are much more satisfactory and the system is therefore rapidly coming into successful use. One of the problems which has

TEST NO. 1

TENSILE TESTS

Twelve strips of ships plate 2" wide, 24" long. Eight strips with butt welds in the middle and four strips unwelded.

Test No.	Description and Size	Original Area Sq. In.	Ultimate Strength		Reduction of Area at Fracture Per Cent	Final Extension in 8" Per Cent	Ratio of Weld to Solid Per Cent
			Total Lbs.	Sq. In. Lbs.			
5939	2" x 3/4" unwelded.....	1.48	86,400	58,400	49	31.5	...
5940	2" x 3/4" welded.....	1.50	87,500	58,300	45	27.0	100
5941	2" x 3/4" welded.....	1.50	88,100	58,700	21	19.2	100
5942	2" x 1/2" unwelded.....	1.02	67,500	66,200	49	27.2	...
5943	2" x 1/2" welded.....	1.01	64,200	63,600	47	18.5	100
5944	2" x 1/2" welded.....	1.03	62,800	61,000	22	14.0	92
5945	2" x 1/4" unwelded.....	.44	29,400	66,800	29	19.2	...
5946	2" x 1/4" welded.....	.44	27,500	62,500	23	6.9	100
5947	2" x 1/4" welded.....	.44	27,800	63,200	25	10.5	100
6018	2" x 1" unwelded.....	1.98	111,400	56,300	53	33.1	...
6017	2" x 1" welded.....	1.94	113,800	58,700	49	26.5	100
6016	2" x 1" welded.....	1.96	113,000	57,600	52	26.6	100

Of the above eight welded strips seven broke outside the weld and only one, No. 5944, broke in the weld, at 61,000 lbs. per square inch. The welds were machined on the surface to the dimensions of the test plate.

TEST NO. 2

TENSILE TESTS

Two ships' steel plates, 1/2" thick, 5' x 3', with butt welds across the center parallel to short sides. Shaped. Four unwelded test pieces cut from solid plate for comparison.

Test No.	Description and Size	Original Area Sq. In.	Ultimate Strength		Reduction of Area at Fracture Per Cent	Final Extension		Ratio of Weld to Solid Per Cent
			Total Lbs.	Sq. In. Lbs.		In 4" Per Cent	In 20" Per Cent	
5120	20" x 49" welded.....	9.80	598,900	61,100	24.7	19.0	11.3	97
5121	20" x 49" welded.....	9.80	596,600	60,900	24.4	9.5*	10.9	100
5120	2" x 48" unwelded.....	.96	60,600	63,100	....	23.5	....	...
5120a	2" x 48" unwelded.....	.98	67,700	69,100	....	22.0	....	...
5121	2" x 51" unwelded.....	1.02	61,200	60,000	....	24.0	....	...
5121a	2" x 51" unwelded.....	.96	58,900	61,400	....	26.0	....	...

Both the above welded plates broke partly through the weld and partly through the solid plate. Welds were not machined but in no case did the welded metal exceed the thickness of the plate by more than 1/16".

* In 8"

TEST NO. 3

MODULUS OF ELASTICITY TESTS

Two strips 12" long, 1" x 1/2" section, built up entirely of deposited welding metal.

Test No.	Description and Size	Original Area Sq. In.	Ultimate Strength		Yield Point per Sq. In. Lbs.	Ratio Yield to Ult. Per Cent	Reduction of Area of Fracture Per Cent	Final Extension in 8" Per Cent
			Total Lbs.	Sq. In. Lbs.				
5035	1" x 1/2" shaped.....	.47	31,100	66,300	42,600	64	17	11.5
Modulus of Elasticity 28,900,000 lbs. per Square Inch								
5036	1" x 1/2" shaped.....	.50	31,500	62,900	39,200	62	26	14.6
Modulus of Elasticity 25,000,000 lbs. per Square Inch								

For comparison it should be noted that the modulus of elasticity of mild steel is 30,240,000 lbs. and of wrought iron 28,000,000 lbs. per square inch.

TEST NO. 4
IMPACT TESTS
Two ships' steel plates, one 1/2" thickness and one 1/4" thickness, each 5'x2' 6", with butt weld mid length parallel to short sides. Blows were applied along the weld across the full width of the plate. Both blows on same side of plate.

Test No.	Description and Size	Span	Falling Weight Lbs.	Height of Fall Feet	Result
2762	1/4" thick, 5'x2' 6"	1st blow, 4' 6"	200	9	Uncracked
		2d blow, 4' 0"	200	9	Uncracked
2763	1/2" thick, 5'x2' 6"	1st blow, 4' 6"	400	12	Uncracked
		2d blow, 4' 6"	400	12	Uncracked

TEST NO. 5
ALTERNATING STRESS TESTS
Thirteen specimens turned 3/8" diameter with butt weld at center. Rotated at 1000 revolutions per minute. Subjected to constant alternating bending movement in region of weld.

Test No.	Description	Calculated Stress at Periphery Lbs. per Sq. In.	Number of Rotations Before Fracture	Results
2680		14,330	4,355,000	Fractured
2687		14,330	5,000,000	Unbroken
2689		16,570	5,000,000	Unbroken
2681		16,800	2,000,000	Broke at junction
2690	Steel plate	18,820	5,000,000	Unbroken
2682	36"x15 1/8"x3/4"	19,040	1,705,000	Fractured
2688	weld, full width	20,830	1,510,000	Fractured
2683	9" from end;	21,050	390,000	Broke at junction
2684	cut and turned up	22,620	2,230,000	Fractured
2691	into 13 rods	25,090	246,000	Broke at junction
2686		26,880	390,000	Fractured
2692		27,550	352,000	Fractured
2685		28,000	150,000	Fractured

NOTE.—It has been determined that an unwelded turned steel bar will withstand a large number of alternations (5,000,000 and over) when the stress varies from +23,500 lbs. to —23,500 lbs. per square inch.

demanded the very closest attention in this type of welding is the composition of the electrode used. The extreme variation in results as to strength accomplished by different operators under identical conditions with the same electrode pointed definitely to the operator. The reducing effect of the arc converted the steel electrode into iron when deposited. The rapid cooling caused severe crystallization, and the exposure of the molten metal was accompanied by rapid oxidation, so that considerable criticism was directed against the method by metallurgists and engineers. Careful training has now made available an increased number of good welders, and research work has resulted in various forms of covered electrodes which prevent oxidation of the molten metal; and, as will be shown in some of the tables of test results attached, it has practically eliminated the objectionable results from the reducing effect by providing electrodes of suitable composition.

With reference to covered electrodes, it has been noted that the covering should have certain specific characteristics, about as follows:

1. The concentric covering around the electrode must have sufficient mechanical strength to withstand shipment and the handling to be expected around a shipyard or in the shop.
2. Covering must melt and flow at the same temperature and rate as the metal core and when molten, the flux must have such viscosity that it maintains its position around the metal during the transmission of the latter across the arc and when deposited in the weld. In this manner, the slag or covering protects the molten metal from contact with the air and thus reduces oxidation.
3. The specific gravity of the coating must be such that it rises to the surface in the molten mass, otherwise it will cause slag pockets in the weld.
4. The coating must be free from elements detrimental to the steel which might be absorbed in it, such as sulphur, phosphorus or silicon in excess quantities. It should preferably contain such elements as carbon and manganese in quantities to replace such elements lost by the reducing effect.

TEST NO. 6
RESULTS OF CHEMICAL ANALYSIS OF ELECTRODES AND DEPOSITED METAL

	Electrodes (Two Pieces A. W. P.) Per Cent	Steel Plate Per Cent	Deposited Metal Per Cent
Carbon (by combustion)	0.149	0.172	0.106
Silicon	0.051	0.020	0.010
Sulphur	0.062	0.034	0.051
Phosphorus	0.050	0.044	0.038
Manganese	0.409	0.430	0.488

TEST NO. 7
COMPARISON OF ARC WELDED AND RIVETED JOINTS IN SHIPS' PLATES LAP JOINTS

Specimen	Lap In.	Sectional Area Sq. In.	Breaking Stress	Remarks
Welded joint	1.5	1.5	26.7	Broke clear of weld
Welded joint	2.0	2.5	25.9	Broke clear of weld
Treble riveted	7.5	9.6	17.2	Broke through rivets
Treble riveted	9.0	9.1	18.9	Broke through rivets

TEST NO. 8
BUTT STRAP JOINTS

Specimen	Size of Strap In.	Sectional Area Sq. In.	Breaking Stress Tons per Sq. In.	Remarks
Welded butt	3.25x.25	2.0	29.8	Broke clear of weld
Welded butt	3.25x.25	2.0	20.0	Broke clear of weld
Treble riveted	12 x.625	6.0	18.3	Broke through rivets
Double riveted	12 x.625	6.0	16.1	Broke through rivets

It is quite probable that more arc welding is being done in this country today by uncovered than by covered electrodes. Very many different compositions are in use and some bare metal electrodes give quite creditable results. There is a general trend, however, towards the covered type, particularly in Great Britain. In this country the covered electrode has been found very desirable where alternating current is used. Alternating current requires greater skill on the part of the operator to maintain the arc, and the covered electrode has some tendency to stabilize and quiet the alternating current arc. From the above it will be evident that the composition of the electrodes is of extreme importance, also the composition of the slag for covered electrodes. It is also evident that different compositions should be used for different classes of work, and it is quite possible at the present time to obtain electrodes to give specific results when used on cast iron, cast steel, rolled steel and even non-ferrous materials.

It not infrequently happens that where arc welding of a general character is practiced, as in a shipyard, only one type of electrode will be used for all kinds of material. It has been the observation of the writer that quite frequently the composition or characteristics of this one will be unknown to the users. Under such circumstances it is to be expected that results will be haphazard and subject to much criticism. It should, therefore, be the object of

DO YOU REMEMBER
—the record-breaking 40-000-volt transmission experiments of the Telluride Copper Company twenty-three years ago? It was conclusively proven at the time that 50,000 volts was probably the upper limit of transmission voltage.

everyone interested in electric arc welding to advance the idea of using such equipment and such operators as will produce proper results.

Arc Welding Machines

Five years ago the machines on the market designed especially for arc welding were limited to a comparatively small number. At the present time practically every electrical machine manufacturer of any importance is prepared to furnish machines of especial design for this purpose either of the fixed or portable type, for the simultaneous use of one or more men, and many concerns will furnish apparatus for either direct or alternating current. The design principle of a majority of the direct current machines is the same; that is, constant energy at the arc. The usual open circuit voltage of the d.c. machine is approximately 60 volts with a welding voltage from 12 to 20. The open circuit voltage of the alternating current machine is approximately 110 and the welding voltage across the arc from 20 to 30 volts. Both types of machines have certain advantages and disadvantages. Where a large amount of welding is to be done in a shop of such character that the work can be brought to the machine, direct current apparatus is usually preferable, one machine being provided with several welding circuits; for portable work in the shop, where it is not possible to bring the work to the machine, either type of machine, depending somewhat upon the electrical distribution system in the shops themselves. For work aboard ship, either type may be used, depending also upon the distribution system on the ways. In general, direct current apparatus is more costly than alter-

nating current, is heavier and therefore less portable. It has an advantage in that much less skilled operators can be used as welders. One of the principal objections to alternating current equipment is the extremely low power factor of this type of machine. It also requires greater skill on the part of the operator. Its cost, however, is much less than the direct current machine.

Results Obtained with Arc Welding

As an indication of what can be accomplished today by arc welding, a series of tables are reproduced herewith, giving comparisons between riveted and welded joints in ship plating and the physical characteristics of welded specimens in comparison with unwelded ones. Tests 1 to 6 show results of tests conducted by Kirkaldy & Sons of London for Lloyd's Register of Shipping. These tests were conducted by a welding company on lap and butt strap joints. It will be noted that the relative cost is given between welding and riveting.

TEST NO. 9
COMPARATIVE COST OF JOINING SHIP PLATES BY RIVETING
AND WELDING

Thickness of Plate In.	Description of Joint	Rivets	Cost per Foot
$\frac{7}{16}$ $\frac{1}{16}$	Single riveted lap.....	$\frac{3}{4}$ " dia.	100 %
	Light welded lap.....		69.3 %
$\frac{7}{16}$ $\frac{1}{16}$	Double riveted lap.....	$\frac{3}{4}$ " dia.	100 %
	Heavy welded lap.....		49 %
$\frac{1}{2}$ $\frac{1}{2}$	Single riveted lap.....	$\frac{7}{8}$ " dia.	100 %
	Light welded lap.....		72.2 %
$\frac{1}{2}$ $\frac{1}{2}$	Double riveted lap.....	$\frac{7}{8}$ " dia.	100 %
	Heavy welded lap.....		50.8 %
$\frac{1}{2}$ $\frac{1}{2}$	Double butt strap.....	$\frac{7}{8}$ " dia.	100 %
	Heavy butt weld.....		46.7 %

Problem Course in Electricity

BY H. H. BLISS

(What difference would it make to the brightness and durability of your lamps if all the wiring in your home were changed? The following article, the eleventh of a series, takes up the relations between wire sizes and voltage, and allied problems. The author is on the staff of Riverside Junior College, at Riverside, California.—The Editor.)

PROBLEMS IN WIRING

Cost of Wire.—Wires used for electric distribution are sold by weight, and as the price per pound does not vary greatly in the range of sizes generally used, we may figure the cost as roughly proportional to the weight.

The weight in turn depends upon the cross section area of the wire, and of course the area is inversely proportional to the resistance. Hence, in selecting the size of wire to fit any given conditions, one has to balance the conflicting advantages of low resistance and low cost of material.

It is, of course, desirable to have as low resistance as possible on account of both voltage drop and power loss. On a lamp circuit, for instance, the voltage at the lamps when all are burning should not fall below 97 per cent of the voltage there when none are lighted, for otherwise the lamps will either give unsatisfactory light or burn out early. The cost of the energy lost in heating the conductors is an expense which must be considered in comparison with the cost of the wire. It has been shown that,

other conditions being constant, the greatest economy results from selecting conductors of such size that the interest on the cost of the wire is equal to the cost of the energy lost in one year.

To calculate the weight of any length of bare wire of given size, refer to the wire table given with the previous set of problems. Divide the lbs. per 1000 ft. by 1000 and then multiply by the length. For problems involving cost, assume a price of 30 cents per lb. for bare copper. Insulated wire weighs more and costs more than bare wire; tables of weights and prices are furnished by manufacturers and distributors.

At 30 cents per lb., how long a piece of No. 11 bare copper could be bought for \$2.70? From the table, 1000 ft. weigh 24.93 lbs.; hence a piece $1000/24.93$ or 40 ft. long weighs 1 lb. Then $270/30 = 9$ lbs.; $9 \times 40 = 360$ ft.

Effect of Changing Voltage.—It is interesting to compare the cost of the wire necessary for transmitting a certain amount of energy for a given distance (a) at low voltage and (b) at high voltage.

For a single example, assume a lamp load of 3 kw., the power to be delivered 500 ft. away with a drop not over 2 per cent of the generator voltage. Com-

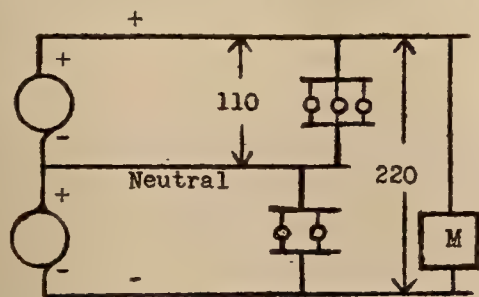


Fig. A.—Three-wire distribution for 110-220 volts. It is possible with modern apparatus to use this method with a single generator or transformer.

pare the weights of wire necessary if the pressure at the generator be taken in turn at 110 and 220 volts.

For the lower voltage, the drop is limited to $.02 \times 110 = 2.2$ volts, leaving 107.8 at the lamps. The current $= 3000/107.8 = 28$ amperes; the resistance of 1000 ft. of wire must not exceed $2.2/28 = .0785$ ohms. From the table we select No. 00 wire, whose resistance is .0778.

With 220 volts the drop is 4.4 volts; current $= 3000/215.6 = 14$ amperes, half as much as before. Resistance $= 4.4/14 = .314$ ohm. Select No. 5 wire, whose resistance is .3128.

The weights of the wires are: No. 00, 402.8 lbs.; No. 5, 100.2 lbs. Hence with 220 volts the cost for wire is only **one-fourth** as great as with 110 volts. It is to be noted that the power loss is exactly the same in the two cases: $28 \times 28 \times .0778 = 61$ watts; $14 \times 14 \times .313 = 61$ watts. In general, for a two-wire system with a given load, a given loss and a given percentage voltage drop, **doubling the voltage reduces the cost of wire to $\frac{1}{4}$** . It is now apparent why, in transmitting current over great distances from the western mountain hydroelectric plants to the big industrial centers of the Pacific Coast, the voltages are set higher year after year; to prevent prohibitive losses, the current in the lines must be brought as low as possible and hence voltages much greater than 100,000 are becoming common.

Three-Wire System.—In spite of the higher cost of the wire for the 110-volt distribution in the example above, there are good reasons for preferring the lower voltage. One is the fact that lamps and appliances can be made more rugged and more efficient for 110 volts than for 220. Another reason is the fact that a person coming into contact with live wires has far less chance of serious injury with the lower voltage. If one side of a 220-volt line is "grounded" (that is, connected to the earth, either accidentally or intentionally), one who touches the other wire is likely to take through the body a really dangerous current.

To get the advantages of the 110-volt system and at the same time hold wiring costs down to approximately the level corresponding to the 220-volt distribution, the "three-wire system" was invented. In Fig. A is shown an example of an early three-wire

distribution; two direct current generators are connected in series, with three leads going to the load. Lamps are connected between the central wire (known as the "neutral") and either outer wire, and motors may be connected in the same way or between the two outer wires. It is customary to ground the neutral, and then a person coming into contact with one outer wire gets only a 110-volt shock. It is very rare that one touches both outer conductors at once.

To calculate the cost of wire in a three-wire system to carry the 3-kw. load of the example above, consider that half the lamps are on each side of the neutral. The outer wires are then figured exactly as in the case of the 220-volt distribution, and the loss and voltage drop will be exactly as in that case. If the neutral is made the same size as the other wires, as is often done, the total weight of wire is $1\frac{1}{2}$ times as great as for the 220-volt system, and $\frac{3}{8}$ as great as for the 110-volt system.

Unbalanced Load.—If half the lamps on one side of the neutral are extinguished while the rest burn, there will be a drop of 2.2 volts in the neutral,

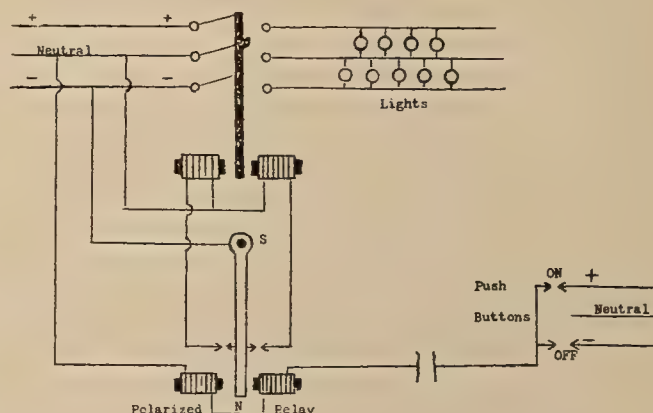


Fig. B.—Three-wire lighting system controlled magnetically from a distance of a mile or more. The armature of the polarized relay is a permanent magnet.

and the lamps used will get 4 per cent less than normal voltage, which is too low to be satisfactory. Hence it is customary to balance the load in such a way that approximately as much current is drawn through one outer wire as through the other.

If the neutral breaks or is disconnected while the load is perfectly balanced, it will make no difference, for under such circumstances it carries no current. But if the load is unbalanced such an accident may cause serious trouble. Suppose that a load of resistance equal to 3 ohms is on one side of a 110-220 volt system and a 10-ohm load is on the other. The breaking of the neutral means that 220 volts will be applied to $3 + 10 = 13$ ohms; the current will be $220/13 = 17$ amperes (if the resist-

DO YOU REMEMBER

—in 1887 when the Journal of Electricity was started, at a time when the electrical industry itself had been in existence not quite ten years and the first electrical paper in New York was only two years old?

ances remain the same), and the voltage applied to the 10-ohm load will be $17 \times 10 = 170$, sufficient to burn out the lamps very quickly.

In this example it was assumed that the resistance of the load did not vary when the breaking of the neutral changed the current. With a lamp load this assumption is not in accord with the facts, for lamp filaments do alter their resistance whenever the temperature changes. Metallic wires, such as the filaments in Mazda lamps, offer more resistance when they get hotter, while carbon filaments decrease their resistance as the temperature rises. Hence if the lamps in the example above were of tungsten, the 10-ohm load, becoming hotter than before, would increase its resistance, while the 3-ohm load would decrease its resistance. There would accordingly result an even more pronounced disproportion of voltage and the quicker destruction of the lamps in the 10-ohm load.

As carbon lamps have a greater resistance cold than hot, when current is started in them it increases comparatively slowly, in contrast with the instant brightness of the tungsten lamp. Had the lamps in the example been of the old carbon type, the difference between the two voltages would have been much less than was calculated.

Remote Control.—The arrangement diagrammed in Fig. B is used on the San Francisco waterfront for lighting piers a mile or more from the office of the harbor electrician. Examination of the sketch will disclose the fact that the control current flows either forward or backward in the single control wire, returning through the earth or the neutral wire. It causes the armature of the relay to move to the right or left, thus sending a strong current to the main magnets which throw the lighting switch.

Answers for First Wire Problems

109. 3600 C. M.; 62,500 C. M.; 4,840,000 C. M.
 110. A one C. M. wire of this length would have $4000 \times 10 = 40,000$ ohms; $40,000/400 = 100$; hence the given wire has 100 C. M. area and a diameter = sq. rt. of 100 = 10 mils.
 111. Area = $300 \times 300 = 90,000$ C. M. Resistance = $7300 \times 10.65/90,000 = .864$ ohm.
 112. $62.5 \times 875 = 54,700$ sq. mils = 69,700 C. M. Resistance of 1000 ft. = $1000 \times 10/69,700 = .1435$ ohm.
 113. A one C. M. wire 860 ft. long would have 8600 ohms resistance; it would take $8600/.3 = 28,670$ such wires to give a resistance of .3 ohm. Hence section area = 28,670 C. M. = 22,500 sq. mils. Thickness = sq. rt. of 22,500 = 150 mils.
 114. A one C. M. wire would have $5/12$ of 10 or 4.17 ohms; the given wire is equivalent to $4.17/.0515 = 81$ such wires. Cross section = 81 C. M.; diameter = 9 mils.
 115. 4.185 ohms; 5.07 ohms.
 116. 220 feet.
 117. No. 28.
 118. For 75% efficiency, the kw. in = the hp. out. 10,000 watts at 100 volts means 100 amperes; 4 volts drop with 100 amperes gives ohms = $4/100 = .04$ ohm in 500 ft. of wire, or .08 ohm per 1000. Hence select wire No. 00.
 119. $250,000/37 = 6,760$ C. M.; diameter = sq. rt. of 6,760 = 82.2 mils. Resistance = $267,750/6,760 = 39.6$ ohms.
 120. Loop resistance = $2 \times 26.775 \times 1.999 = 107$ ohms. Drop = 32.1 volts. Remaining voltage = 7.9.
 121. Length of average turn = $3.14 \times 4.2 = 13.2$ in. = 1.1 ft. Total length = $360 \times 1.1 = 396$ ft. Resistance = .396

$$\times 6.374 \times 1.064 = 2.69 \text{ ohms. Current} = 22/2.69 = 8.17 \text{ amperes. Ampere turns} = 8.17 \times 360 = 2,940; \text{ watts} = 22 \times 8.17 = 180.$$

Second Set of Wire Problems

Note: A wire table arranged conveniently for working these problems is to be found in the previous issue of the Journal of Electricity, page 530.

122. In a certain large building one pair of wires must carry 85 amperes a distance of 175 feet from the switchboard. Find the safe size of rubber covered copper wire and the weight of copper in it. What is the drop in this line?

123. A small spool contains 70 feet of bare copper wire, No. 20, B & S Gage. The spool is sold for 30 cents; calculate the cost of copper per pound.

124. In the diagram of remote control (Fig. B), does the control current flow into or out of the paper at the upper side of the right hand relay magnet when the "ON" button is pressed? Which way does the current flow in the other relay magnet?

125. How long must a No. 2 copper wire be in order that its weight in pounds may equal its cross section area in circular mils? Repeat for No. 20 and No. 36 and get an approximate rule for all sizes.

126. At 400 feet from a 115-volt generator there is to be installed a d.c. motor which takes 36 amperes at full load and 3 amperes at no load. Find size of wire to use to limit the voltage drop to 4 volts, and determine voltage at motor at no load.

127. A load of 42 kw. is to be transmitted a distance of 6,000 feet on two wires. The input to the line is not to exceed 45 kw. Find weight of copper required if the voltage at the load = 600. Repeat for a voltage of 2400.

128. A three-wire system has No. 10 wires 125 ft. long. Find voltage at each lamp if generators give 116 volts each and there are 40 half-ampere lamps on each side of the neutral. Find voltage at load if all the lamps on one side of the neutral are turned off.

129. On the basis of the data for wire No. 5, calculate the weight of one cubic foot of copper.

130. Ten 880-watt electric stoves are connected to the same 110-volt circuit 70 feet from the switch cabinet. What size copper wire must be used to limit the voltage drop to 3 volts? Is this wire large enough to be safe?

131. Find the cost of copper at 30 cents per lb. for a three-wire system delivering 5 kw. at 120-240 volts 1300 ft. from the generator with voltage drop not to exceed 3% of the voltage at the load. Make the three wires of the same size.

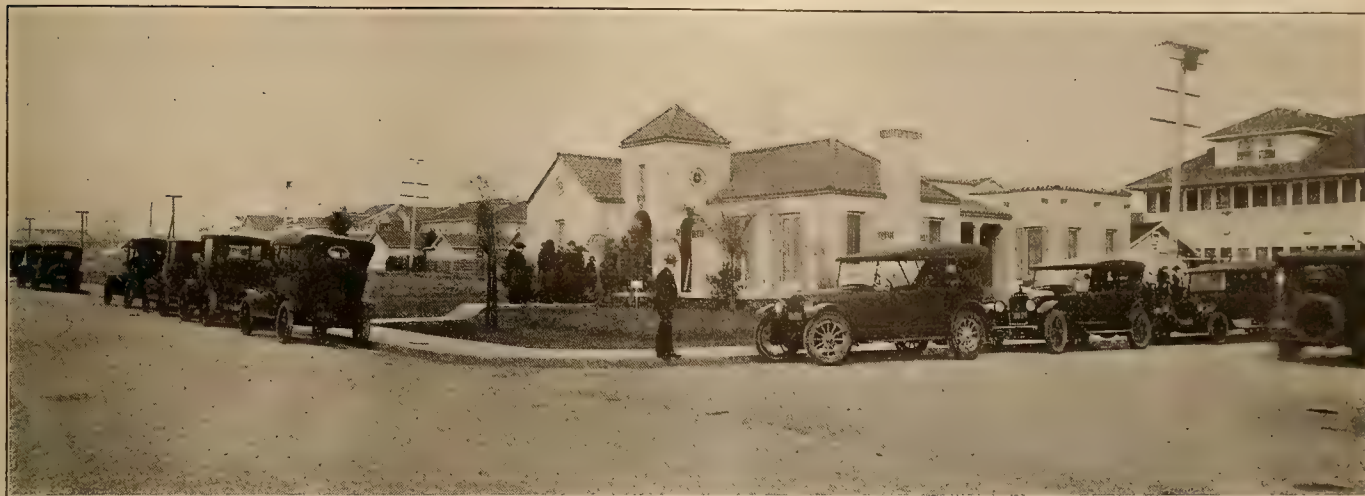
132. What is the voltage distribution in the system of Problem 131 if the neutral breaks when there is a load of resistance equal to 6 ohms on one side of it and 9 ohms on the other? Assume 247 volts at the generators.

133. If the ampere-turns on a certain magnet = 12,000, find the applied voltage. The number of turns is 2400, and the average length of one turn is 8 inches. The wire is 40 mils in diameter and has 10.7 ohms per C. M. foot.

134. A motor and a generator 319 feet apart are connected by two No. 8 copper wires. If the generator delivers to the line 18.9 kw-hr. in 10 hours, and the motor (of 75% efficiency) gives out 1.80 hp. continuously, what is the current in the line and the voltage at the motor?

TELEPHONING PHOTOGRAPHS

A photograph that was telephoned from Antwerp to the Matin office in Paris recently, depicted Swedish women athletes marching in the Olympic Games Stadium. The photograph was telephoned the 200 miles in eight minutes. Considerable attention is being given in London just now to the use of the telephone in connection with the transmission of photographs. One London newspaper has interested itself in this new development of pictorial telephony and has displayed whole pages of really first-class photographs that were submitted many miles away by telephone.



This Electrical Home of Los Angeles is one of the several which have been opened to the public under the auspices of the electrical industry in California. They have done more than any other one factor to impress the advantages of the convenience outlet upon the public mind.

A Year's Work for Cooperation

BY LEE H. NEWBERT

(Among achievements of the electrical industry in the West, the California Electrical Co-operative Campaign holds a distinctive place. The chairman of the Advisory Committee here reviews the Campaign's work during the past year, and outlines the work planned for 1921.—The Editor.)

A glance back over the work done in 1920 by the California Electrical Co-operative Campaign shows many accomplishments within the electrical industry and for "Better Service to the Public."

Spreading the Convenience Outlet Idea

Outstanding among these accomplishments of 1920 is the development of the convenience outlet idea which has been received with enthusiasm by the electrical industry, and not less enthusiastically by the public and those who serve them in home planning and building—namely, our friends the architects, subdividers and builders. Many of these throughout the state have been visited, and to them has been explained the service which they can render to their clients and customers by providing proper wiring and adequate convenience outlets in the homes, apartment houses and business buildings which they desire, build or sell. The majority of them grasped at once the fact that the interests of themselves, their clients and the electrical industry are at one in this matter, and the few who doubted must certainly have been convinced by the interest in proper wiring and convenience outlets shown by the 150,000 visitors who have crowded the five Modern Electrical Home exhibits opened to the public in California during the past few months. The unquestionable value of the service which the Co-operative Campaign is able to render to the public and to the electrical and other industries concerned with home building by cultivating the idea of proper wiring and adequate convenience outlets, is the real reason for this work of the Co-operative Campaign having met with such encouraging success. "Better Service to the Public" is our motto and better service to the public must be the outstanding result of our efforts if the results are to be worthy of the effort involved.

The Newspaper's Electrical Page

Not less important than the convenience outlet idea, although from its very nature less easy to evaluate in terms of service to the public, is the advertising campaign which was conducted during the past year and which closed August 1st after Electrical Pages had been established in newspapers of all towns in California large enough to support them creditably. While the amount of advertising space and publicity obtained for the electrical industry was large and of material value to the industry, the more important result achieved was the awakening of all branches of our industry to the fact that every desirable kind of publicity should be employed to carry to the public the industry's message of its service and its problems, and above all the idea of the mutual self-interest of the public and the industry in the development of California's hydroelectric energy. Much good also has been accomplished in improving the character of all electrical advertising by continually emphasizing the value of truth and an ethical attitude toward competition. I venture to express the opinion that none of the electrical advertisers who have come closely into contact with the work of the Co-operative Campaign would now consider for a moment the violation of either of these fundamental principles of good business and good advertising, and that as a result the advertising of the electrical industry is fixed on an ethical plane which will amply justify the confidence of the public.

DO YOU REMEMBER

—In 1897 when Lander, Wyoming, then a town of 1500 inhabitants, hauled the materials for its electric plant 150 miles from the nearest railway over mountain trails on mule back?

Cooperating with the Contractor-Dealer

A highly important part of the past year's endeavor was the continuation of the work upon the problems of the individual electrical contractor and dealer, store location and arrangement, window and interior display, store management and salesmanship; all received their just proportion of the field representatives' efforts, and to learn of the advance made along these lines one has only to observe the contractor-dealer establishments of today and contrast them with those of a year or two ago. Another phase of the contractor-dealer's business which has received special attention from the Cooperative Campaign is that of proper accounting. Much good has been accomplished through the installation of the Standard Accounting System of the National Association of Electrical Contractors and Dealers by the representatives of the Campaign. Moreover, the importance of proper accounting methods in the determination of present conditions and future policy in any electrical retail business has been brought home to the minds of all branches of the electrical industry in California, so that the interest now manifest in this most vital subject gives promise of even greater forward strides during the coming year.

Cooperation, that cumulative force which creates great undertakings and in their achievement re-creates itself, has developed in an inspiring degree within the electrical industry of California through the medium of the California Electrical Cooperative Campaign, until the eyes of the electrical industry of the entire country are turned with interest to observe its results and to learn its methods. Those at a distance are often better able to place a proper value upon its work and it is indeed gratifying to learn that the principles and methods of cooperative effort in California are being approved and adopted by the electrical industry in many other sections of the United States, and that the "California Idea" bids fair to become nation-wide.

Plans For the New Year

With such evidences of confidence in the underlying principles and policies of the California Electrical Cooperative Campaign, the Advisory Committee undertakes the work of the coming year with renewed vigor, and has formulated its plans with confidence but with care. Briefly, these plans include the following principal lines of action:

1. Extensive development of the convenience outlet idea, including personal work with architects, builders and subdividers, the establishment of Modern Electrical Home exhibits in all the principal cities and towns of the state, and lectures and bulletins on the industry's part in developing the convenience outlet idea. This work will include the presentation of this idea to the electrical journeymen, because the Advisory Committee believes that the workmen who come daily in contact with the public can aid materially in extending to the public the convenience outlet idea, and will gladly do this when the self-interest of the electrical journeymen in this matter has been pointed out to them.

2. Proper accounting by electrical contractors and dealers will be furthered through lectures on this subject before local groups of contractors and dealers, and by bulletins addressed to the various branches of the industry in California, explaining how they can assist in promoting better accounting. The presentation of this subject by the Cooperative Campaign will tie in with a correspondence course on

Accounting for Electrical Contractor-Dealers now in preparation by the University of California and based on the Standard Accounting System. The Advisory Committee believes this will afford the contractor and dealer the fundamental understanding of accounting which is so necessary to the proper conduct of any business which expects to develop.

3. The Advisory Committee recognizes the vital importance to the electrical industry and the public of the rapid development of our hydroelectric resources. It will therefore undertake to present this subject to the industry and to the public through a Speakers' Bureau, providing speakers of recognized authority to present on all proper occasions the message of the service of the electrical industry to the public and the necessity for action by the public in their own interest to make this service available. The work of the Speakers' Bureau will be correlated with the work of the Public Relations Committee of the Pacific Coast Section, National Electric Light Association, and will be supplemented by bulletins and other publicity sent to the industry and to the public.

4. The Cooperative Campaign will devote much time to the subject of Industrial Illumination during 1921. The exhibit of industrial lighting in San Francisco is now open and the work of installing a similar exhibit in Los Angeles is under way. These will be permanent exhibits of the same general description as the exhibit at the Pasadena Convention of the N. E. L. A., and lectures on the principles of proper industrial illumination and the benefits to the industrial or commercial establishment utilizing such service, as well as the beneficial effect upon employees and the consuming public, will be presented on announced dates in connection with the exhibit.

In addition to the permanent industrial lighting exhibits at San Francisco and Los Angeles, the Advisory Committee is providing for a portable exhibit which will be shipped from city to city in California, covering the industrial territory outside the cities of Los Angeles and San Francisco.

The foregoing outline is not intended to create the impression that other activities of the Campaign are to be discontinued. The Advisory Committee will continue its work with all the problems of the contractor-dealer as well as with the various other questions affecting "better service to the public." Armed with the fruitful experiences of the past three years, and reposing its confidence in the continuation of that fine cooperation of the electrical industry which has made possible the successes of 1920, the Advisory Committee believes that 1921 will surpass in achievement any year of the history of the California Electrical Cooperative Campaign.



A neat window display in the store of E. Brettell, president of the contractor-dealers' association, Vancouver, British Columbia

Work of the Electrical Jobbers in 1920

BY C. C. HILLIS

(The effectiveness of the electrical industry depends upon the combined cooperative activity of its various groups, and a realization that their interests are the same. The chairman of the Pacific Division of the Electrical Supply Jobbers' Association outlines in the following article the contribution of the jobbers to the well-being of the whole.—The Editor.)

This is the period of the year for taking inventory. Individuals should take stock of their efforts during the year to see how closely they have followed the Golden Rule and if they have shortcomings, they should turn over the proverbial "new leaf" at the beginning of 1921. Mercantile establishments are taking inventory to determine whether their business is going to show up for the year in red ink or on the right side of the ledger. It is also the proper time for industries to take inventory of their efforts, to determine whether they have been directed along lines that have had an uplifting influence and have made for a definite advancement for the companies and individuals engaged in them.

In taking stock of the work which the electrical supply jobbers of the Pacific Coast have been doing for the advancement and upbuilding of the electrical industry on the Coast, it is found that they have been playing many parts. I believe it is fully recognized that the Pacific Coast Electrical Supply Jobbers have for years been found prominent among those working for the betterment of the electrical industry and striving to bring about the best relations among the different branches of the industry, in order to insure harmony and a better understanding of their mutual problems.

For many years the jobbers have taken a very active interest in the work and problems of the electrical contractor-dealer and it is no doubt due in a considerable measure to their efforts that the electrical contractor-dealer, doing business on the Pacific Coast, is recognized as being far ahead of those similarly engaged in other sections of the country along all lines of business practice, good merchandising and a recognition of the proper ethics of the industry.

California Electrical Cooperative Campaign

It was the electrical jobber who took the first step towards having the central station better understand the work they were doing for the development of all things that made for improvement in the industry, and this culminated in giving the jobbers a place in the Geographic Section of the National Electric Light Association, out of which grew the cooperative work now being carried on by the Advisory Committee and known as the California Electrical Cooperative Campaign, the Advisory Committee being taken from all of the branches of the industry, and on which the jobbers have had a representative who has taken a very prominent and active part in all of its work.

In recognition of the close harmony prevailing on the Coast the Electrical Supply Jobbers' Association, at their national meeting held at Del Monte in May, appointed a committee to go to Pasadena and

attend the national meeting of the National Electric Light Association, which was held there the week following the electrical jobbers' meeting in Del Monte.

At the national meeting of the electrical supply jobbers above referred to, the cooperative program of the electrical industry on the Coast was explained in detail to all the visiting members and their guests, and it is hoped by the electrical jobbers generally throughout the nation that the cooperative spirit so well known here on the Coast may be emulated by those engaged in the industry in other sections of the country.

Homes Electrical

During the past few months a great deal of good work and publicity has been given to the electrical idea by the Homes Electrical put on exhibition in San Francisco, Sacramento and Oakland, at which exhibitions thousands of people had an opportunity to see up-to-date and properly equipped electrical homes. In these exhibits the jobbers have given freely the use of their salesmen for demonstration purposes, in some instances have loaned material for display purposes and have helped in the financing of the publicity necessary to bring the general public to pay a visit to these exhibits.

Cooperation of Jobbers

The service given to the customers of jobbers during the past year is one of which the jobbers should feel proud. The most trying conditions, such as unusual manufacturing difficulties, freight embargoes and delays in delivery, due to freight congestion, strikes, etc., have been fairly well solved by the electrical jobbers who boldly endeavored to carry stocks much larger than would be needed under more nearly normal conditions, and with few exceptions the jobbers have given very excellent service. This service was largely improved and made possible by the close harmony that exists among all of the different competing jobbers and through their unselfish cooperation in the way of interchange of stocks when any particular jobber was short. The letting go of merchandise—in many instances goods which had a ready sale—by one jobber to his competitor in order that he might give service to his customer, is surely the acme of the spirit of cooperation, and I believe that the customers of the jobbers

DO YOU REMEMBER

—that on Feb. 11, 1854, San Francisco was first lighted with coal gas, a banquet given at the Oriental Hotel honoring this occasion? The price per 1000 ft. was \$15, coal was \$36 to \$40 per ton, labor \$6 to \$7 per day and interest 36% per annum.

generally fully appreciate what this has meant to them.

The credit departments of the various jobbers have worked very closely together and have also been helpful to the contractor-dealers, giving them any help and advice in matters pertaining to financial questions where they were of any use. Where they could assist in the installation of proper accounting methods and systems for proper cost data on contracting jobs, they have freely given of their time, and that branch of the industry as a whole has through their effort undoubtedly been improved.

The jobbers have taken a very active interest in the effort being made to further better illumination in stores, offices and factories and were more than willing to donate part of the material used in the installation of a demonstration room, which has recently been installed in one of the offices of the State Accident Commission in the Underwood Building. This demonstration room, as far as possible, duplicates the demonstration shown at the Pasadena Convention of the National Electric Light Association. The demonstration is made with the idea of arriving at proper illuminating conditions under which employees may work with safety to their eyesight and improve their efficiency, and in no way gives publicity to any particular manufacturer's goods. There is no denying that few buildings where people are employed are properly illuminated to get the most efficient results, and when the general public realizes the illuminating conditions under which they have been working for many years, it will no doubt bring about changes in their establishments which will improve their own efficiency, giving wiring jobs for the electrical contractor-dealer, help the manufacturer and jobber and incidentally make a better customer for the central station.

Assisting Central Stations

One of the new movements taken by the electrical jobbers is the one to assist the central stations in the sale of their stock so that their program of extension for the next few years may be more easily accomplished. At an open meeting of the Electrical Jobbers at Del Monte about six months ago this subject was discussed at some length, and at a meeting there in October a number of manufacturers and central station representatives were in attendance and took part in a further discussion of this subject. As a result a committee was appointed to make a thorough investigation and see what the jobbers could do to help. As was pointed out in the discussion, the community develops as the central station develops. If the lighting companies are unable to give adequate service to all their customers, or are not in a position to take on the service of all who may apply for it, it serves to retard development in all lines of industry. Obviously, therefore, people in all walks of life should be interested in seeing the lighting and power companies properly financed so that all communities may be given service, and the entire state an opportunity to develop and grow. This function of the central station in the development and growth of communities is not very well

understood, even by a large percentage of the people who are directly connected with the electrical industry, and it is not strange, therefore, that people in other lines of business should not see how vitally affected their own business might be if the central station cannot continue to satisfactorily perform its functions of serving a community with heat, light and power.

It is the thought of the jobbers that the people in the electrical industry should at first be made acquainted with the obligation which those in the industry owe to the proper development of the lighting companies and that the public at large should, as soon as possible, be informed of just what this development means to them from a self-interest standpoint.

This jobbers' committee, working in connection with a further committee appointed by the Electrical Development League of San Francisco, is now studying this problem from all its angles and it is hoped that a successful plan can be worked out by which all engaged in the electrical industry may be induced to purchase stock of the lighting companies, which is now being offered for sale and which returns a very good rate of interest on money invested. The plan contemplates enabling the employees who are not able to buy stock outright to purchase this on a partial payment plan. While the total amount of stock which the employees can purchase will not go very far towards the work of financing the additional extensions, it will serve the purpose of getting each individual in the industry more vitally interested in his industry's problems and will show the bonding companies in the Eastern financial centers that all those engaged in furthering electrical matters on the Coast are working in harmony.

The electrical jobbers at all times have their coats off and are prepared to go to the bat and work for the good of the industry as a whole.

ELECTRICAL POWER PRODUCTION IN SOVIET RUSSIA

The generation and distribution of electric power in Russia is under the control of the Soviet department of electricity. This department manages 10 nationalized power plants, 45 nationalized factories for electrical machinery, telephones and telegraphs, and 19 works not yet nationalized. The aims of the Soviet government are to build new power plants and to supply electric current to farmers, sawmills, mines, and to all larger foodstuff producers.

A statement issued by the government regarding the future of the electrical industry in Russia is full of optimism and goes so far as to say that all the resources of the country will be utilized by electric power, bringing the country to a state of prosperity unparalleled in its history. At present only 8,000,000 kw-hr. are produced in Moscow per month, and still less in Petrograd, owing to the shortage of fuel. In Moscow only three of the existing five power plants were running in January, but the other two have been put to work since.

A Page of Cooperation Figures

FINANCES

1918		1920	
Contractor-dealers	\$2,000	Contractor-dealers	\$3,600
Jobbers	3,200	Jobbers	6,000
Manufacturers	1,300	Manufacturers	9,000
Power companies	5,900	Power companies	9,000
		Technical press	270
	\$12,400		\$27,870

The success of the cooperative idea is nowhere better attested than in the increased subscriptions to the California Electrical Cooperative Campaign during the past two years. Note especially how the contributions of the manufacturers have increased since the opening year of the Campaign.

CONTRACTOR-DEALER ASSOCIATION

Increase in membership, November 1, 1919, to April 1, 1920	160
Present membership	315
Increase in dues @ \$60, November 1, 1919 to April 1, 1920....	\$ 9,600
Total revenue from dues.....	18,900
Appropriated to Campaign.....	3,600

The increase in membership in the Contractor-Dealer Association during the past year of the Campaign's work, and the corresponding increase in dues, is a practical illustration of the growth in group interest and the resulting financial benefits both to the Association and Campaign.

STORE IMPROVEMENTS

		Per Cent
Number of stores.....	400	100.
New stores	90	22.5
Better locations	70	17.5
Remodeled	95	23.75
	255	63.75
Accounting systems installed.....	75	23.00
Minor improvements	400	100

Some of the tangible results achieved by the Campaign during its first year of active work are interestingly shown in the above figures. Minor improvements include such things as additional lighting, new arrangement, and everything short of remodeling the store.

CHRISTMAS ADVERTISING

	1918	1919	Gain
Column inches by dealers.....	19,488	100,649	81,161
Number of insertions.....	1,218	6,337	5,119
Publicity		7,520 inches	
Efficiency of clipping service:			
Advertising, 75%; publicity, 50%			

The value to the electrical dealer of timely and adequate advertising has been consistently pointed out by the Cooperative Campaign, and the increased publicity activity as shown by the Christmas figures above, testify to the practical results and to the retailer's cooperation and success in putting over the "Electrical Christmas" idea.

SOLICITORS

1918—26 dealers	30
Power companies	60
1919—82 dealers	176
1920—100 dealers	200
Average monthly salary	\$ 150
Aggregate monthly salary.....	30,000
Total monthly sales (estimated).....	300,000
Aggregate yearly salary.....	360,000
Total yearly sales (estimated).....	3,600,000

It is significant that with the increase in the number of solicitors employed by retailers, the power companies have tended to withdraw from the field. The salaries and commissions which it is profitable to pay these solicitors indicate resultant increase in sales.

ELECTRICAL APPLIANCES

Homes in United States.....	22,000,000
Homes wired for electricity.....	7,000,000
Average investment in electrical equipment.....	\$ 150
7,000,000 homes @ \$150.....	1,050,000,000
@ \$600	4,200,000,000
5,000,000 new homes required, @ \$760.....	3,750,000,000
Possible appliance business.....	9,000,000,000

AUTOMOBILE SALES IN CALIFORNIA

1912	83,000 cars
1920	491,000 cars
Business done in past eight years.....	\$450,000,000

A comparison of the investment in electrical equipment in the average home with that necessary for adequate electrical convenience shows that the saturation point is still far off. The fact that automobile sales could increase business by \$450,000,000 in eight years should point the way for the electrical industry.

CONVENIENCE OUTLETS — WASHINGTON

Homes in Washington.....	350,000
One convenience outlet to each home @ \$2.....	\$ 700,000
20 convenience outlets to each home @ \$2.....	14,000,000
Loss by not encouraging sufficient outlets.....	13,300,000
New homes needed.....	70,000
20 convenience outlets to each home at \$5.....	\$ 7,000,000
1 convenience outlet to each home @ \$5.....	350,000
Possible additional business	6,650,000

ELECTRICAL APPLIANCES — WASHINGTON

Homes in Washington.....	350,000
New homes required	70,000
Average investment in old home.....	\$ 150
Investment required to make home electrical.....	750
Total possible new business.....	262,500,000

The increase in home building is the contractor-dealer's opportunity, as shown by the above figures on possible new business for Washington. Cooperative work in the industry is being largely directed towards the proper electrification of the home through more convenience outlets.

ELECTRICAL CONVENIENCE OUTLETS—OREGON

OLD HOMES	
Homes in Oregon	185,000
Average number of convenience outlets—1 each @ \$2....	\$ 370,000
Convenience outlets required under plan, @ \$2.....	7,400,000
Loss by not encouraging sufficient outlets.....	7,030,000
NEW HOMES	
New homes required.....	35,000
20 outlets to each, @ \$5.....	\$3,500,000
1 outlet to each, @ \$5.....	175,000
Possible additional outlet business under new plan.....	3,325,000

ELECTRICAL APPLIANCES — OREGON

Homes in Oregon	185,000
New homes required.....	35,000
Average investment in old home.....	\$ 150
Investment required to make homes electrical.....	750
Total possible new business.....	137,000,000

The sale of appliances is definitely related to the number of convenience outlets in the home. The present average is one outlet per home; the proper quota is estimated at 20. A lack of activity in promoting the electrical home idea involves a tremendous loss for the contractor.

DO YOU REMEMBER

—that in February, 1896, Fresno was planning to celebrate the completion of power connections to the city—a project which two years later was in the hands of a receiver?

Art in the Electrical Store

(Electrical merchandise has been sold with hardware and in department stores, and combined with many other kinds of goods. Here is an account of a high-class electrical store which combines it successfully with art goods, and attains thereby a distinctive atmosphere which is among the contractor-dealer's most valuable assets.—The Editor.)

This is not just one more treatise on the artistic arrangement of the electrical store but an account of an electrical store which looks like an art store, and indeed is partly an art store. It reaps its advantage in that it has also captured the atmosphere of the art store, with all its charm and leisureliness, its appeal to the woman buyer, and its ability to tempt the customer to "browse." Not that all electrical dealers must necessarily turn their stores into art stores, but the success of the Spott Electrical Company of Oakland, California, commands interest in, and respect for, its methods.

The manager will tell you firmly that this is not a "contractor-dealer store." It is an electrical retail store; the contracting department is kept a mile or so away in an entirely different part of town.



This charming rest room for ladies was later transformed into a fixture room, the attractions of the rest of the store proving so strong that it was very rarely used.

Plugs and wire and sockets and lamps are not featured in this charming interior, though you can find them all in a not too conspicuous corner. All the different kinds of merchandise are segregated, so that one show case contains nothing but shining percolators, and another nothing but electric irons. In the window displays, also, appliances are kept entirely separate from table lamps, for instance; as the store has a corner location with several windows, this plan is very easily carried out.

The floors of the windows are of polished wood, and long drapes of bright cretonne or dark velvet, according to suitability, set off the display. There are no prices in the window, as if they are large enough to be seen they spoil the appearance, and also make the first impression one of prices instead



Interior of the Spott Electrical Company's store dressed for a gala occasion. Flowers, however, are a regular part of its arrangement.

of quality and service. Inside, however, every article has a small price tag, so that it is not necessary for the salesman to be in constant attendance while the customer makes a leisurely selection, or looks around while waiting for his package to be wrapped. No display cards are used.

Besides electrical appliances, lamps, fixtures, and all the usual small wares of the electrical retail store, the Spott Company carries various art goods for the home such as pottery, vases, fire screens and book ends. These not only lend themselves very readily to effective display, but tacitly assume that art goods and electrical goods are not at opposite poles, and that beauty and utility belong together. The advantages in display are quickly seen where the light from a tall standing lamp falls on a dark polished table covered with old bronze and blue bowls, and farther on an artistic fire screen and a great copper vase full of flowers give a home touch to a room devoted entirely to fixtures.

The Home Atmosphere

Delicate grey paneled walls and white paint set off the soft rich colors of the interior, and rugs and wicker chairs create an atmosphere which is calculated to make the woman shopper feel as much at home as in an establishment devoted to Paris fashions. Moreover all the salesmen are women, who can sell irons and percolators and grills in the idiom of their women customers. Also—so says the manager—they give to the store arrangement the home-like touch which the mere heavy-handed male finds hard to imitate with far greater effort. A special little sitting room was originally prepared for women customers, but was later abandoned as it was found that the women did not use it, preferring to wander about the store.

Character in Display

Jewelers' cases are freely used in the display of the smaller appliances as being the best means of keeping the articles in first-class condition, and providing a neat and attractive system of arrangement. The very large appliances such as washing machines and electric ironers are relegated to the background, not only because they do not harmonize with the general character of the store, but because they are not considered among the store's specialties. A large washing machine business usually means an elaborate time-payment system, and the Spott establishment has found that its merchandising sales have developed more profitably along its own particular lines—fixtures, lamps, the smaller appliances, and art goods.

Business Methods

Accounts are kept separately for the four divisions of Fixtures, Motor, Construction, and Merchandising. Fixture work is a specialty, and there are three or four small rooms adjoining the main part of the store devoted entirely to the display and demonstration of fixtures of all kinds.

Advertising is done through an agency, and by means of signs outside construction work. There is no soliciting of any kind. The system is to give

unlimited attention to the individual customer, making perfectly sure that each is more than satisfied, both with his purchase and with his treatment; and results have proved that a friendly customer is one of the best business-getters. Conversely, it is fully realized that a sale which does not give the customer permanent satisfaction is likely to deprive the firm of far more business than the price of the article. A bad sale is not merely not an asset, but a definite loss. For this reason, also, only first-class standard goods are stocked, and no repairs are made on other than standard goods.

The Spott Company's store is an excellent illustration of the dollars-and-cents value of "tone" in a



A sample of newspaper advertising, illustrating the policy of selling illumination rather than fixtures, thus emphasizing beauty and quality rather than price.

retail establishment. There are a number of ways of creating this tone, and each dealer must work it out for himself, according to the demands of his business, his location, and his customers. But the fact remains that the distinctive atmosphere, the touches which give the store individuality and a character, play a phenomenally large part in the building up of an electrical retail business.

DO YOU REMEMBER

—when plans were first made for crossing San Francisco Bay by electric span in the record-breaking 110-mile Blue Lakes transmission line of the Blue Lakes Water Company, headed by Prince Poniatowski?

Pamphlets and Clippings in a Business Library

BY VIRGINIA FAIRFAX

(Files may be as bad as waste baskets if they are not handled with intelligence and skill. In the following paper, the fifth of a series, the librarian for the Carnation Milk Products Company discusses the proper classification and indexing of pamphlets and clippings. The series is copyrighted.—The Editor.)

HOW INFORMATION IS CLASSIFIED AND INDEXED — Part 1

Readers must bear in mind that these articles relate to care of pamphlets and clippings in business libraries. In many public libraries this class of material is considered ephemeral, as advance sheets of information which later will be received in book form, and no records whatever are made. The material is filed alphabetically according to subject, and in the official and public catalogs "See also" references are inserted at the end of the subject entries, that direct the inquirer to the special subject information in the vertical files.

In a business library, however, the bulk of this material will have permanent value, and much of it will represent all the facts that the library will ever have on some subjects. Under these circumstances it is wise to have some record, a record of possession, or of receipt, of the most important contents of the files. A business library is worked **intensively**, it cannot accumulate as a public library does; office space is very valuable, so it "plows deep" and makes available and useful every fact in a small amount of material. In other words, the material is closely analyzed for information that bears on the company's interests and every paragraph of value is made to furnish its quota of facts. It has been said that "a public library wants a little of something on everything, but a business library wants everything on something," and in this latter case an analysis of the contents of the pamphlets must be made.

Simplicity in Filing

In some libraries the material placed in these vertical files has been arranged by the Dewey Decimal System in order to make it correspond with the classification of the books in the library, and with the mistaken idea that unless a decimal system is used there is no provision for subdivisions of a subject. The decimal system is too intricate for a subject vertical file; neither is it sufficiently expanded in many of the most vital subjects of today. Its use requires a complete author and subject catalog, which is not necessary for its class of material, and the making of which takes much time and thereby delays material from getting into circulation as quickly as possible. Another objection to the decimal system is that the catalog must always be consulted, as a key, before any material can be found, whereas the straight alphabetic subject arrangement permits of direct consultation of the files.

An arbitrary numbering, that is, a straight numerical system, has also been tried as a method of arranging this class of material, and it has many of the same objections that are found in using the decimal system, especially that of having to consult

an index before being able to locate any material in the files.

A straight alphabetic subject arrangement is far superior to the decimal or numerical systems of classification. Its simplicity is its strongest recommendation. It is simple to prepare and simple to operate. It may be expanded indefinitely and it brings all subdivisions of a special subject together. It is intelligible to the uninitiated in library technique, that is, it is not an enigma to the business man who may want to get material from the files when the librarian is absent.

Time-Savers

There is also great saving of time in cataloging if the alphabetic subject arrangement is used. Under the decimal and numerical systems, not only must main author cards and analyticals be made for everything put into the files, but main subject cards also. With a straight alphabetic subject arrangement, only the briefest records are made which correspond to an abbreviated author card, and these only for important pamphlets and analytical subject cards. It is far safer to have these brief records of the information rather than omit them and depend on the memory and presence of the librarian for facts which in case of his absence may not be located. The main subject card is omitted because the pamphlets are filed in folders marked with the main subject name, and thus again time is saved by the elimination of the main subject card.

Various methods relating to the details of making these records, or the indexing and marking of the material for identification in filing, have been tried in many business libraries. After a careful study of these methods and the elimination of details that the writer believes are unnecessary or a duplication of records, the following rules are presented that have been found to give the maximum results with a minimum of effort. The adoption of these rules makes an accurate working reference file with as little expenditure of time and labor as is possible, at the same time making every bit of information accessible.

It is indeed necessary that the organizer of such information files be a trained librarian. It is necessary that he know thoroughly the principles of cataloging, as it is impossible to abbreviate methods unless they are understood in their entirety. It is necessary also to have knowledge and experience in assigning subject headings and the use of Cutter numbers. Added to this knowledge a keen interest in the company's business, with a close study and appreciation of its interests, will develop a business library with an information file that will render efficient worthwhile service.

Rules for Filing

Preparation of Material —

On receipt of material it is well to see that covers of pamphlets are intact and to mend torn leaves where necessary. If clippings are to be filed in the same folder with other printed matter, mount them and indicate source and date on article, if space permits, otherwise on the mounting, and stamp all material with the name of the library, with or without date of receipt. Bind articles and manuscripts as explained in article four of this series.

In all business libraries there are certain periodicals that will be bound, or kept permanently in pamphlet boxes for future reference, while others are not worth this expense, as they contain facts of current interest or only occasionally an article that seems worth indexing or clipping. In the case of the periodicals to be kept permanently, all articles of importance should be indexed immediately under their subjects and in the case of those that are eventually to be discarded, mark and index the article and indicate on outside cover the page number of article indexed and file the periodical in its pamphlet box. At the end of the year or when it is decided that these are no longer worth keeping, the librarian should go through the boxes, and aided by the notation on covers, clip articles of value for permanent filing and throw remainder of the periodical away. Sample periodicals and periodicals to which the library does not subscribe or has purchased because of a certain article, should be clipped immediately. The references to articles in periodicals may be made on a colored card to distinguish them from book and information file references.

Subject Headings —

Every piece of printed matter for the information files must be assigned a definite subject name. The pamphlet should be carefully examined or read and its main subject decided upon and notes made of other subjects of interest that it may contain. How close an analysis and how much indexing depends on the needs of the library and on who will use the files besides the librarian. The H. W. Wilson Company indexes are helpful in choosing subject headings, that is, the Industrial Arts Index, the Agricultural Index and the Public Affairs Information Service, all of which are published at 958 University Avenue, New York City. These indexes have been found more helpful in selecting subject headings for this class of material than The A. L. A. List of Subject Headings because they index from month to month the latest information not yet in books, and have therefore more detailed and up to date subject headings on facts of current interest.

The Newark Public Library has published a small book called "List of Subject Headings for Information Files" that is a list used for their information files, and while it contains many subject names that are of only local interest or useful in a public library, it also contains suggestive subject headings for a business library.

It is always preferable to choose subject headings from indexes that are already prepared and in

use. This aligns the information files of the individual business library with similar material in other libraries, and, as it were, standardizes the subject headings and makes the files easier to use in conjunction with other files and indexes. In addition to the subject headings found in these printed indexes each business library requires subject headings for its specific interests that are not found in printed indexes, or subjects that are not sufficiently expanded in these indexes to meet the need for detailed subject headings of specific interest to a particular business library. In such cases the librarian must study the needs of the organization, must also learn its vernacular and use the same terminology for specific interests as is used by the members of the organization. For example, "Bloats" and "Swells" are terms used in the canning industry to indicate defective cans of food and mean the same thing. But "Swells" is applied to cans of fruits and vegetables while the term "Bloats" is used for the same condition by the canners of milk.

Someone has suggested the use of the dictionary for choosing proper words for subject headings. Study the definitions and synonyms and select the word that most specifically expresses the subject of the material in question. Thomas' Register and Hendricks' Commercial Register may also prove helpful in selecting appropriate subject headings, though these are more helpful in assigning subject headings for trade catalogs than for information files.

It is necessary to keep at hand, where it may be quickly consulted, a list of the subject headings used in the files, in order to avoid assigning new terminology to the same subject and also to keep the subject terminology uniform. This list should always be consulted before assigning a subject heading, and is best made on the temporary index slips, L.B. catalog No. 1190 or 1192, and filed alphabetically in a cardboard box that may be kept on the librarian's desk or in desk drawer.

WINDOW DISPLAY IN PORTLAND STORE



The above is from a photograph of a window display of the Stubbs Electric Company, Portland, Oregon. Notice that the window is separated from the store proper by only a low partition—making the store also a part of the display. The bright metal of the appliances is thrown into striking relief by the heavy rich drapes on the pedestals.

SPARKS—Current Facts, Figures and Fancy

(The very latest reports from the railroad, airplane, oil and financial world appear on this page. If you are interested in the wide distribution of the electrical farm, in the production of eggs or in the waterfalls of Iceland, you will also find valuable data herein.—The Editor.)

The railroads of the country are planning upon a new supply of 1,800 engines, for which they expect to pay \$100,000,000.

* * *

Hardly a day passes that does not bring a report of some new and novel application of electricity. The shoemaker's world is welcoming an electric heater devised to soften shoes so that they be easily lasted by hand or by machine.

* * *

If you can't find a home, go to Long Beach. This youthful city of southern California has passed Boston in her 1920 building activities. With a population of 55,593 she reached a total of \$1,102,700 in building permits for October.

* * *

Even the waterfalls of Iceland are to be utilized in carrying out an extensive program of water-power development. The Icelandic Finance Minister is most optimistic concerning the future industrial development through the use of hydroelectric power.

* * *

Believing that it is more profitable to give than to receive, the United States is boasting of the fact that she is now the foremost lender of the world. A calculation places 13 to 15 billions as the minimum net amount of American credits extended to the world outside.

* * *

The California State Railroad Commission has authorized public utilities to issue securities totaling \$1,001,500,000 during the past eight years. Gas and electric companies rank first in the amount of securities issued, with \$398,000,000 against the steam railroads' \$324,000,000.

* * *

Large quantities of food as well as other materials are required in the construction of a power house. According to the commissary's report 1,023,000 pounds of fresh meat, 57,000 dozen eggs, 900,000 pounds of potatoes and 75,000 pounds of coffee are among the items on the bill for the Caribou plant construction up to November 1.

* * *

Thanks to the inspiration of electricity, the wholesale production of eggs is becoming very popular. There is a hatchery in Montana which is most surely doing its bit to bring down the price of eggs. It has a capacity of 10,000 eggs which will be used to supply the Yellowstone and Glacier national park hotel systems with fresh eggs and poultry.

* * *

Reports from the airplane world are varied and encouraging. An aerial survey of the King's River mountain country is being made, looking to the

development of hydroelectric power. A northern California physician finds the plane inestimably valuable in making rush calls, and one of our daring fliers enjoyed a three-hour trip from San Francisco to Los Angeles.

* * *

In France they find that there is enough power to run a turbine in a simple jet of water. The water from a reservoir 200 feet above the factory comes down through a vertical tube less than an inch in diameter. The strongest men cannot cut this jet with the best-tempered sword, and in some instances the blade has been broken into fragments without deflecting a drop of the water.

* * *

It's a bit hard to think of the electrical farm in Belgium but it is rapidly being located there, according to accounts which come from a recent commercial exhibition at a Brussels park. Electric washers, heaters, storage batteries and wiring devices received especial attention even from King Albert and the Queen and it is the general sentiment that farms should be restored on the modern electrical basis.

* * *

The enthusiastic inventor announces that we will soon have to drop the term, "boring for oil," because it may not be bored for any longer. An electrical device is predicted which will locate the oil because of the higher electrical resistance of oil as compared with other constituents of the earth. A circuit is formed by a series of batteries and a reduced deflection of a sensitive instrument in this circuit indicates the presence of oil.

* * *

Modern invention is rapidly robbing the sea of its mystery and its danger. The radio enables a ship to obtain its bearings at any time; the hydrophone, which utilizes the sound of the propeller reflected from the bottom of the sea, ascertains the depth of water at a moment's notice; hurricanes are detected long ahead of time by the radio telephones, and the captain is always fully informed as to the direction of storms and the location of icebergs and shipwrecks.

* * *

Predictions are being made that shortly California will take from Oklahoma leadership as the greatest oil producing state in the Union. Oklahoma's average is around 305,000 barrels per day, while in October California averaged 305,102 barrels a day. This figure and the promising fields now under development make the leadership prediction look highly probable. Twenty-five per cent of the oil pipe lines in the country are required to handle this California production.

PERSONALS

A. G. Wishon has recently been appointed vice-president and managerial director of the San Joaquin Light & Power Corporation. Mr. Wishon has been connected with the San Joaquin Light & Power Corporation since its beginning, and is one of the pioneers of hydroelectric development in the West. He has been succeeded as general manager by A. Emory Wishon who for a number of years has been assistant general manager. These promotions were made necessary by the increase in size of the San Joaquin Light & Power Corporation which



has recently added to its generating capacity, and is going ahead with an aggressive construction program. Both of these promotions are in the nature of a reward for the constructive work done by these men in the development of the San Joaquin company and the executive ability which they have displayed during the trying post-war period.

Claude C. Newkirk, manager of the Peet Bros. plant, has resigned his position to become the head of the new corporation which has purchased the Pacific Insulation and Refrigeration Company. The company expects to locate in Richmond.

R. E. Smith, acting secretary of the California Electrical Cooperative Campaign, has left the industry to accept a commission as Captain in the U. S. A. Corps of Engineers.

I. A. German, former sales manager of the Atlas Electric Company of Salt Lake City, has recently taken over the retail electric store known as Elder Brothers Electric Company, and has opened it under the name of "The Home Electric Company."

J. Waldo Smith, Chief Engineer of the Board of Water Supply of the City of New York was in San Francisco during the first part of this month. He addressed the members of the Engineers' Club and their guests on the water supply of New York City.

Commander Bryson Bruce, machinery division, Mare Island, has been appointed engineering officer of the super-dreadnaught California. Mr. Bruce is reputed to be one of the most efficient engineering officers in the navy. Commander H. E. Brown, assistant to Bruce, has been named as his successor.

Huston Thompson, of Colorado, has become chairman of the Federal Trade Commission for a term of one year. Mr. Thompson, who was vice-chairman during the past year, succeeds to the chairmanship under the rule of the Commission which provides for rotation in the office of chairman among the several commissioners.

Carl C. Thomas, Western representative of Dwight P. Robinson & Company, Inc., recently consolidated with Westinghouse, Church, Kerr & Co., Inc., has left Los Angeles to report in New York on southern California conditions. Mr. Thomas has announced that the engineering and construction company which he represents is planning several huge projects which involve the development of water-power and irrigation. It is reported that the cost of completing these projects will run into millions of dollars.

W. D'A. Ryan, illuminating expert with the General Electric Company, is handling the lighting of Reparto Miramar, one of the finest residence districts in Havana, Cuba. There will be ornamental standards twenty feet in height, four to each central grass plot. The standard carries two, with a 1000-candlepower lamp in each globe.

Elwood Mead, Professor of Rural Institution in the University of California, and chairman of the State Land Settlement Board, has accepted an invitation from Governor Henry J. Allen of Kansas to address a conference of legislators and farmers on the California Land Settlement plan, at the State House, Topeka, Kansas, December 14. Enroute to the Kansas conference, Mr. Mead addressed a gathering of real estate men at Los Angeles, December 10th. Following the convention, he will speak at a conference at Minneapolis.

H. Foster Bain, consulting engineer, spent several days in San Francisco recently upon his return from the Orient, where he made extensive explorations in the interest of the Yunman Mining Corporation. Mr. Bain was at one time editor of the Mining and Scientific Press and during the war, assistant director of the Bureau of Mines. At the present time many are hoping that Mr. Bain will accept a recent appointment as director of this bureau.

Henry Bostwick has been made manager of the San Francisco division, in connection with the recent reorganization of the Pacific Gas & Electric Company, effective December 1; John D. Kuster, of the San Jose division; Lee H. Newbert, of the East Bay division; H. G. Ridgway, of the North Bay division; E. W. Florence, of the Sacramento division; Chas. S. Northcutt, of the San Joaquin division; H. M. Cooper, of the Drum division; E. C. Johnson, of the Colgate division; I. E. Adams, of the DeSabra division; H. B. Heryford, of the West Side division; G. R. Milford, of the Shasta division, and H. C. Ross, of the Fresno division.

Burrell S. Manuel has been appointed general manager of the Electric Railway and Manufacturers' Supply Company

of San Francisco. Mr. Manuel is a Westerner, having received his training in the electrical industry in Denver, Colorado, with the Mountain Electric Company with whom he started to work in 1901. From 1904, when the Westinghouse Electric & Manufacturing Company opened an office in Denver, until 1918 he was connected with this office, acting as manager. In 1918 Mr. Manuel was moved to East Pittsburgh as manager



of the appliance section of the company which handled fan motors, heating appliances and ranges. The following year the heating appliance business increased to such an extent that he was moved to Mansfield to take charge of the Westinghouse Electric Products Company, from which position he came West to become general manager with the Electric Railway and Manufacturers' Supply Company. The electrical industry is glad to welcome him to the Pacific Coast, and wishes him all success in the new position he is so well fitted to fill.

DO YOU REMEMBER

—that 25 years ago it was feared that the Welsbach burner would prove a dangerous rival to the incandescent lamp and would eventually supplant it for home lighting?

Floyd N. Averill, manager of the Fobes Supply Company of Portland, Oregon, has been appointed chairman of the recently formed finance committee of the Northwest Electric Service League. This definite step toward putting the League into active operation follows the successful series of "barnstorming revivals" which have broken preliminary ground for the work in the state of Washington. Oregon has already laid the foundation for an enthusiastic support of the movement, largely through the effective work of both the contractor-



dealers' organization and that of the electrical supply jobbers of Portland, who have for some time been working closely together toward the betterment of the industry. The personnel of this important committee who will work under Mr. Averill's leadership is announced elsewhere in this issue.

Corliss A. Berclaw, representative of the Educational Department of the Westinghouse Electric & Manufacturing Company, East Pittsburgh, visited in San Francisco during the past week and has now gone to Los Angeles.

Carl F. Uhden, Assistant City Engineer of Seattle, in charge of construction activities on the Skagit Power Project for the City of Seattle recently addressed the Municipal League of Seattle on "Status of Work at the Skagit."

L. A. Lewis, of the Washington Water Power Company, of Spokane, was a recent Seattle visitor. He took a very prominent part in the launching of the Northwest Electrical Service League and banquet held on the evening of November 29.

R. T. Stafford, Manager of the Allis-Chalmers Manufacturing Company's Seattle office, recently made a short trip to Victoria, B. C., coming home via Vancouver where he visited and attended to business in the Vancouver offices of that company.

Al Dodge, well-known construction engineer, who has been in charge of the building of the Southern Railway in China, returned during the past month and announces that the civil war in China has caused a temporary delay in the continuance of this work.

L. W. Chapman, Pacific Coast editor of Chemical and Metallurgical Engineering, is traveling over the Owens Valley, California, and parts of the state of Nevada, with a view to studying the industries engaged in extracting the various chemical salts from the alkaline soils of those regions.

W. J. Grambs, Manager of Auxiliary Operations of the Puget Sound Power & Light Company, was the guest of honor at a dinner given at the Seattle Board's Merchant Marine Training Station in recognition of his work during the World War as supervisor of the recruiting service of the United States Shipping Board. Mr. Grambs was presented with a beautiful bronze ship's clock and barometer combined as a token of the esteem with which he is held by his former associates in the service.

Fred M. Abbott, who has been special investigator and safety inspector for the public utilities commission of Utah for the past three years, has tendered his resignation. Mr. Abbott, in addition to his investigating work, has had charge of executing the wishes of the commission with regard to general safety conditions. His work has attracted the attention of the claims departments of some of the larger railroad lines, and he has received several offers of positions with them. He has not yet announced what his future plans are.

Samuel Kahn, vice-president and general manager of the Western Gas and Electric Company, Stockton, California, spent several days in San Francisco recently.

J. V. Baum, stoker engineer of the South Philadelphia works of the Westinghouse Electric & Manufacturing Co., is in the Northwest in the interests of the stoker business of his company.

F. M. Kerr and H. H. Cochrane, vice-president and manager and chief engineer, respectively, of the Montana Power Company, are spending some weeks in the Eastern offices of that company.

Fletcher Hamilton, State Mineralogist, and W. W. Thayer, of the California Mining Bureau, have returned to San Francisco after a two months' trip which covered every county in California, and which was taken for the purpose of arousing the public to the necessity of supporting the measures of relief for gold mining which are embodied in the McFadden Bill. This bill was introduced, but not acted upon by the last Congress, and provides for an excise tax of \$10 an ounce on new gold in manufactured articles. It seems that never before in the history of the state was the gold mining industry in such an unsatisfactory condition.

Arthur R. Kelley has joined the organization of the Southern California Edison Company in charge of the newly established department of Estimates and Valuations. Mr.



Kelley graduated from Purdue University in 1903 with the degree of B.S. in electrical engineering and followed this with the two-year apprentice course with the Western Electric Company in Chicago. Mr. Kelley served successively as local manager of the Citizens' Telephone Co. of Anderson, Indiana; electrical engineer for Seattle, Renton and Southern Railway

of Seattle; assistant engineer for the Public Service Commission of the state of Washington; electrical engineer for the California Railroad Commission, where he organized a department for handling appraisals, and since 1914 has been in private practice as consulting engineer with headquarters in San Francisco, specializing on valuations of public utility properties. During the war Mr. Kelley was commissioned Captain of Engineers, assistant to Major Geo. W. Seever, power administrator for California, Oregon and Washington, under the Power Division of the War Industries Board.

OBITUARY

Raphael Weill, president of Raphael Weill & Co., Inc., of San Francisco, died December 9th in Paris. Raphael Weill, a native of France, has been prominent in San Francisco civic life for sixty-five years and his death breaks one of the cherished links between the present day and the famous "days of gold."

James W. Bell, vice-president of the Wagner Electric Manufacturing Company of St. Louis, and one of the pioneer capitalists of the electrical industry, died in St. Louis during the early part of November.

Benjamin Holt, president of the Holt Manufacturing Company, inventor of the caterpillar tractor, and a leader in the development of the tanks which took such a great part in the war, died in Stockton on the fifth of December. Mr. Holt stands among the most honored of Western men because of his contribution to agriculture and the upbuilding of Western industry.

HAPPENINGS IN THE INDUSTRY

ASSOCIATION OF UTILITY COMMISSIONERS CONTEMPLATED

Members of the public utilities commissions of Utah, Nevada, Montana and Idaho have recently concluded a conference at the state capitol in Salt Lake City with a general discussion of problems common to all. The matter of express rates, which was one of the reasons for the calling of the conference, was left to the individual commissions to decide, in the light of what had been brought out by the discussions at the conference.

The commissioners found, however, that the exchange of ideas and general discussions at the present conference had been so helpful and beneficial that the proposition of forming an inter-mountain association of utilities commissioners was favored.

In the absence of other members of the visiting commissions no action could be taken. It was left with Judge Joshua Breenwood, president of the Utah Commission, to correspond with other commissions to ascertain if some sort of an association of the kind suggested would be agreeable to all.

BILL FOR NATIONAL PARKS

Secretary Payne has recommended to Congress, legislation to exclude national parks from the provisions of the water power bill. The bill drafted by the secretary provides that permits for such developments may be secured only by special acts of congress.

CARIBOU TUNNEL COMPLETED

Work of boring tunnel No. 2 of the Great Western Power Company's Caribou project was completed December 1, according to a recent report. This tunnel, which is 9,200



Interior view of the Caribou tunnel under construction

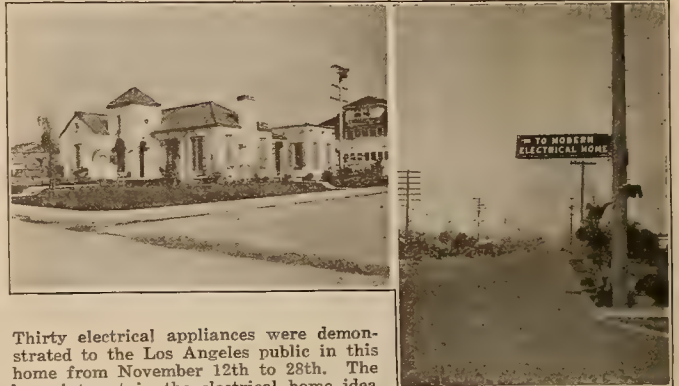
feet long, begins in Butt valley and goes through the ridge to a point 1100 feet above the Caribou power plant.

This will enable the plant, which has a capacity of 60,000 horsepower, to begin generation of electricity early in February.

PERMIT ASKED FOR PIT RIVER DEVELOPMENT

The Pit River Power Company has applied to the Federal Water Commission in Washington for a preliminary permit to go ahead with power development on Pit River above Copper City. The Commission has set February 10 as the time for considering the application and hearing any objections that may be made in the meantime.

LOS ANGELES ELECTRICAL HOME



Thirty electrical appliances were demonstrated to the Los Angeles public in this home from November 12th to 28th. The keen interest in the electrical home idea which was aroused here will undoubtedly serve to give the larger home, which is to be opened January 15th unprecedented popularity.

WASHINGTON ADVISED OF FILING ON POWER PROJECT

The federal water power commission has advised Gov. Hart, of Washington, of the filing of an application by the Washington Irrigation and Developing Company of Seattle for a preliminary permit for a power project on the Columbia River at Priest Rapids. This company, of which Henry J. Pierce is president, plans to spend \$150,000,000 in the development of power at Priest Rapids, rivaling that at Niagara Falls.

Upon advice of the State Attorney-General that under provision of the federal water power act the state is given preferential right to potential water in its borders, the governor has notified the state hydraulic engineer, the state reclamation board and the Columbia Basin survey commission of the situation in order that an investigation may be made to ascertain whether the state desires to make filing at this point.

ELECTRICAL CODE FOR NEVADA FORMULATED

At a recent meeting of electrical engineers, held in Reno, regulations governing construction operation and maintenance of overhead and underground electrical wires in Nevada were discussed. The rules have been approved by the public service commission and will become the code for use in Nevada as soon as sufficient books are printed for general distribution.

The regulations were prepared by a committee appointed by the public service commission. The following were members: F. O. Broil, engineer for the commission; E. D. Brown, representing the power companies, and R. W. Mastick of the Bell Telephone Company, representing signal utilities. Two laboring men were also members.

DO YOU REMEMBER

—when in 1896 contracts were being let for the Big Creek development, a 150-kw. plant to furnish power to the city of Santa Cruz, California?

SUPREME COURT ORDERS RE-HEARING OF "SPECIAL CONTRACT" CASES

In the special contract cases, in which the Public Utilities Commission of Utah recently handed down a decision whereby a number of large power customers of the Utah Power & Light Company, who are holders of "special contracts" with that company, were placed on standard schedules, two of the customers—namely, the United States Smelting, Refining & Mining Company and the United States Fuel Company—have obtained from the Supreme Court of Utah a writ of certiorari directed to the Public Utilities Commission. The writ is made returnable December 16, which means that under the rule of the court the matter will be argued at that time. In the event other customers take similar action against the Commission, the Supreme Court may set a later date for the hearing of all the cases at the same time.

The order of the Public Utilities Commission denying a re-hearing in the power contract cases was issued on November 10 and the companies have thirty days, under the law, in which to apply for writs of review.

COURSE IN ELECTRICITY OFFERED IN IDAHO

The Idaho Technical Institute is offering a course in practical electricity. This course is given especially for men who are in the trade or are interested in following the trade. Professor Ralph H. Walters, a member of the Electricians' Union and an expert electrician, will give the course. The entire equipment of the Idaho Technical Institute electrical laboratory is available.

CITY AND GOVERNMENT MAY JOIN IN SOUTHWEST DEVELOPMENT

Los Angeles city officials have been in conference with Arthur P. Davis, director of the United States Reclamation Service, outlining a program for the development of municipal hydroelectric power in conjunction with a gigantic government scheme for reclamation of desert lands.

The discussions included the joint undertaking by the United States government and the city of Los Angeles of the impounding of hundreds of acres of water from the Colorado River and the Mono watershed.

It was pointed out that the two schemes would bring the reclamation of millions of acres of arid lands in California, Nevada, Arizona and possibly Utah, and give to Los Angeles additional power plants, totaling a development of 620,000 horsepower.

ELECTRICAL SHOW HELD IN VANCOUVER

Vancouver, B. C., held its first electrical show under the auspices of the British Columbia Electrical Cooperative Association from November 22 to 27, during which time it was visited by ten thousand people. The show was placed under the management of E. E. Walker, sales engineer, British Columbia Electric Railway Company and chairman of the Advisory Council of the B. C. Electrical Cooperative Association, with J. F. Little, local manager of the Northern Electric Company, as assistant manager. The other members of the committee were:

E. Brettell, display and decoration; W. W. Fraser, illumination; J. Muirhead, light and power supply; E. H. Hughes, entertainment; W. C. Mainwaring, space allocation; J. Lightbody, publicity, and H. Pim, finance. The firms exhibiting were: British Columbia Electric Railway Company, Canadian General Electric Company, Northern Electric Company, Electric Supply and Contracting Company, Western Power Company, Hoover Suction Cleaners, Kanaly's Ltd., Jarvis Electric Company, W. W. Fraser, E. B. Horsman & Son, Rankin & Cherrill, B. C. Telephone Co., Modern Utilities Company, Percy Letts, Perry Electric Co., Farr, Robinson & Bird, Crossman Electric Co., The Electric Shop, and Muir Electric Co.

The show entailed an expenditure of nearly \$8,000, some of which was defrayed by gate admissions, some by the rental of space and the balance was a deficit against the Association.

ONE HUNDRED THIRTEEN APPLICATIONS FOR POWER PROJECTS FILED

One hundred and thirteen applications for permit or license for power development have been filed with the federal power commission, it was announced December 9.

Among the applications recently received were:

Five dams, four reservoirs and two power houses in head waters south fork, San Joaquin river, Southern California Edison Company, Los Angeles, Cal.

Dam on Colorado river at Lee's ferry, Arizona, creating a reservoir extending up-stream 300 miles and controlling annual flow of river, Southern California Edison Company.

DREDGING OF SAN FRANCISCO WATER FRONT CONSIDERED

Development of the Islais Creek-India Basin district of San Francisco's water front, rendering 280 acres of submerged land useful to commerce and industry, is urged by the Board of State Harbor Commissioners, who have placed their case before the United States District Engineer preliminary to obtaining an appropriation from Congress for the dredging of this area.

Ultimately, the improvement will provide berths for forty-nine steamships, each 500 feet in length, and six berths for vessels 300 feet in length.

RECLAIMING THE DESERT



During the last five years over one hundred and fifty miles of power distribution lines have been built in the Antelope Valley, the western boundary of the Mojave desert, and electric pumping and irrigation has now raised the value of the property from \$40 to \$500 per acre. The principal crops are alfalfa and Bartlett pears.

RESOLUTION FOR THE BENEFIT OF THE INVESTING PUBLIC

The Central States Group of the Investment Bankers' Association of America, comprising the states of Illinois, Wisconsin, Indiana and Iowa, urges the sane, sober business men and women of Illinois to safeguard the State Public Utilities Commission.

Following the precedent established last spring by the governing body of the entire association, the executive committee of the Central States Group has adopted the following resolution:

"Be It Resolved, That the Executive Committee of the Central States Group of the Investment Bankers' Association of America views with great apprehension any attack upon the principle of commission regulation of public utilities, knowing that such public utilities are owned, not as popularly supposed, by a few people, but by thousands of investors whose savings are invested in such public utilities, either directly or through savings banks and insurance companies, and that such savings will be imperiled and the service of such utilities to their respective communities hampered, and strongly advises the people of Illinois to safeguard their present public utilities law in every possible manner and make clear their determination that this modern, progressive, economically scientific method of administering the public utilities of their state shall not be tampered with."

CONTROVERSY OVER CUSHMAN POWER SITE

The city of Tacoma recently began, in the Superior Court at Shelton, Washington, its fight to secure the right to condemn property in Mason county for the development of the Lake Cushman power site, which the city has a contract to purchase. A lively fight by the Frank McKean interests, rival power claimants, is promised before the case is concluded. The city, through its Superintendent of Lighting, Llewellyn Evans, has produced evidence to show that the city is now using nearly the maximum capacity of the La Grande plant for lighting and other public uses, and that increase of the La Grande plant cannot be economically accomplished.

SAN DIEGO CONSOLIDATED PLANS PURCHASE OF PLANT

The San Diego Consolidated Gas & Electric Company is planning to purchase from the San Diego Electric Railway Company the power plant owned by the street railway company in the city of San Diego, according to an application filed with the California State Railway Commission by the railway company. The price to be paid for the power plant is given as one million dollars. According to the application filed, it is the purpose of the railway company to purchase from the San Diego Consolidated Gas & Electric Company power with which to operate its electric lines, the rate to be paid to be fixed by the Commission.

A NEW NORTHWESTERN ELECTRICAL STORE

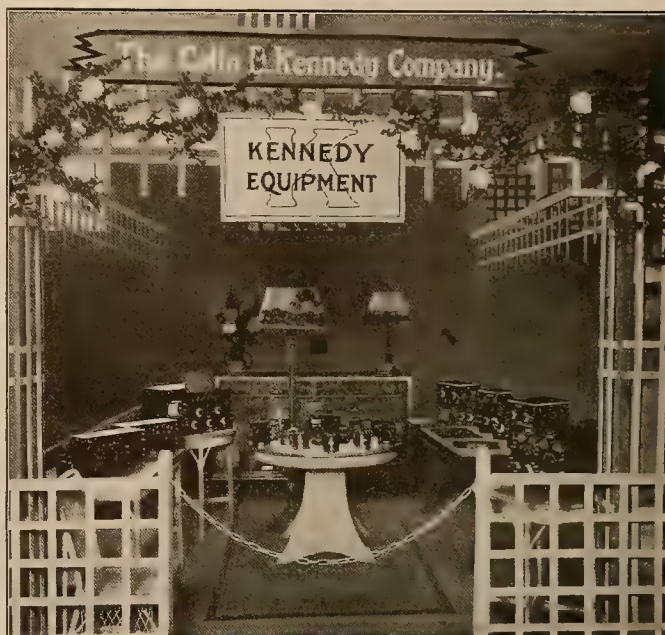


Interior of the Pioneer Electric Company's store, recently opened in Port Angeles, Washington. One of the devices employed to attract a crowd on the opening day was a performance by a Marathon pianist, who played continuously for thirty-six and one half hours. The proprietor of the store, A. L. Phillips, is shown standing in the foreground, second from the left.

SERVICE STATIONS SHOWN ON MAP

The Westinghouse Electric & Manufacturing Company, Springfield, Mass., has issued a map of the United States measuring 9 by 12 inches which shows the transcontinental highways in heavy black lines, the interstate auto routes in light red lines, and the location of its service stations. On the back of the map is a description of the starting, lighting and ignition equipment which this company manufactures.

THE PACIFIC COAST RADIO SHOW



This exhibit of the Colin B. Kennedy Company radio receiving apparatus attracted considerable attention at the Pacific Coast Radio Convention which was held in San Francisco during the latter part of November. The outstanding result of this convention was the conviction that some dependence on Eastern manufacturers of radio equipment is no longer necessary. It was evident that the standard exhibited by apparatus of Pacific Coast manufacture compared most favorably with that produced in Eastern centers.

COMPARATIVE COST OF MELTING BRASS IN ELECTRIC FURNACE AND GAS FIRED CRUCIBLES DURING JUNE, 1919

	Electric Cost per Ton Melted	Gas Cost per Ton Melted
Pounds of metal poured during month.....	35,215	18,210*
Electric energy (480 kw-hr.).....	\$13.64	
Gas (18,600 cu. ft.).....		\$12.65
Labor	6.25	8.00
Lining	1.00	1.00
Crucibles		7.00
Metal shrinkage:		
Electric, 1.31 per cent, at 18 cents.....	4.71	
Gas, 2.62 per cent, at 18 cents.....	4.71	
Electrode consumption at 27 cents per lb.....	1.08	
Gas for heating ladle, 600 cu. ft. at 68 cents per 1000 cu. ft.....	0.41	
Total.....	\$27.09	\$38.07
Saving by use of cheaper scrap made possible by electric furnace.....	2.88	
Average net melting cost.....	\$24.21	\$38.07
Average saving per ton melted in electric furnace, \$13.86.		
*Estimated.		

DO YOU REMEMBER

—that in 1898 the Pacific Electric Transmission Association, the forerunner of the Pacific Coast Section N. E. L. A., adopted its constitution at an open meeting held in the Crocker Building, San Francisco?

REVIEW OF POWER, OIL AND GASOLINE SITUATION BY PROMINENT BANKER

The outstanding features of a study which W. W. Woods of the First National Bank of Los Angeles has been making of the power, oil and gasoline situation on the Pacific Coast are being sent to the larger power companies of California by the Pacific Coast N. E. L. A. Public Relations Committee, and a request is being made to distribute this material among the newspapers in the respective territories.

"The final census statistics for 1920 give California a numerical increase in population over 1910 of 1,048,987. At the same time the power consumed in California has jumped from 1,250,000,000 kw-hr. in 1910 to 3,750,000,000 kw-hr. in 1920.

"This means that the demand for power has increased not alone at the same rate of population increase, but to a much greater extent, and there is not a man or woman in California today who does not know of the power shortage which California has faced during the last two years, or who has forgotten the oil and gasoline shortage of three months ago. This year 50 per cent more wells were required to produce practically the same amount of oil as that produced five years ago.

"California's oil consumption is outrunning her production at the rate of more than 10,000,000 barrels a year. This can only mean that as the population increases and as demands for fuel also increase, the price of fuel oil and gasoline will mount so rapidly that this state must inevitably turn largely to some other fuel for its power. No influence on earth save rationing the supply, can keep the present prices stationary.

"When the point was reached in any city where it would be difficult to obtain the necessary driving force for factory wheels, the contracts were placed elsewhere, and what was true for war, by order, must, by force of economic conditions, become the basic industrial law in California within the next ten years.

"It is for this reason that those who have the interest of this state at heart are particularly anxious that the hydroelectric programs of the various power companies may not be held up and also that such organizations as the Union Oil Company of California, which has announced a program of ship construction to bring into California from Mexico the necessary fuel oil to make up at least a part of our own shortage, may have the full support not only of the business interests but of the whole people of the state."

DEMAND FOR P. G. & E. STOCK

Sales of the Pacific Gas and Electric Company's first preferred stock on the recent offering have passed the \$3,000,000 mark. Up to the close of business on December 9, 1934 sales, aggregating in all \$2,999,000, had been closed.

The total number of stockholders as of that date, was 13,112, of which 10,273 were holders of the preferred and 2839 of the common stock.

These figures show that the company's preferred stockholders have increased in number eight-fold since Vice-President Hockenbeamer inaugurated his "customer ownership" plan on June 3, 1914.

Public utilities in various parts of the United States have placed more than \$100,000,000 worth of securities with their customers since the "Hockenbeamer" plan was first put into operation in California.

PUGET SOUND NOTE ISSUE

The Puget Sound Power & Light Company is offering for sale to its patrons and the investing public another \$1,000,000 of its 8 per cent, five-year gold coupon notes. This is the second million dollars of an authorized issue of \$2,000,000 of these securities. The first million dollars' worth was sold in September of this year.

SAN JOAQUIN BOND ISSUE AUTHORIZED

Authorization has been given to the San Joaquin Light & Power Corporation by the State Railroad Commission to issue \$2,625,000 in bonds to pay notes and expenses connected with construction work at Bakersfield and at the Kerckhoff hydroelectric plant.

SOUTHERN SIERRAS BOND ISSUE

A Railroad Commission order issued recently authorizes the Southern Sierras Power Company to issue \$1,040,478.55 of its first and refunding 6 per cent bonds for the purpose of financing in part the cost of plant extensions, additions and betterments.

MOUNT SPOKANE COMPANY BOND ISSUE

The Mount Spokane Power Company which supplies Deer Park, Milan, Chattaroy, and Denison near Spokane has made a \$20,000 bond issue. Mark Mendenhall, president of the company, recently said: "We are now completing the plans for rebuilding and enlarging the lower and older plant of the company which will give the two combined plants a capacity of 650,000 horsepower."

WESTINGHOUSE CAPITAL AND INDEBTEDNESS INCREASED

At the special meeting of the stockholders of the Westinghouse Electric & Manufacturing Company, at East Pittsburgh on November 18, an increase in the indebtedness of the company by the sum of \$30,000,000 was authorized. Also the stockholders in this meeting voted to authorize an increase in the capital stock of the company from \$75,000,000 to \$125,000,000.

COAST VALLEYS GAS & ELECTRIC COMPANY NOTE AND BOND ISSUE

Coast Valleys Gas & Electric Company has been authorized to issue \$375,000 of its first mortgage bonds and \$220,000 of its 10-year 8 per cent notes. The bonds are to be sold at not less than 80 per cent of their face value and the notes at not less than 94. The moneys obtained through the sale of the notes are to be used by the company to pay the cost of plant extensions, additions and betterments. A supplemental order authorized the company to issue \$125,000 of its bonds at 80 per cent of their face value.

TRADE NOTES

This Year's Lamp Sales Expected to Reach 230,000,000 —

Lamp manufacturers are working to capacity to fill the existent demand and are finding it possible now to make satisfactory shipments. From estimates which have been made at this time it appears that total sales of large lamps, tungsten and carbon, will amount to approximately 230,000,000 for the year 1920. Of this amount sales of carbons will account for about 15,000,000 lamps. This leaves 215,000,000 tungsten vacuum and gas-filled lamps of the large size, which, compared to sales for the year 1919, shows an increase of 38 per cent for the present year. Miniatures will probably total just over 100,000,000 lamps.

Fairbanks, Morse & Co. Purchases Company —

Fairbanks, Morse & Co. have purchased the entire business consisting of all stock on hand, good-will and liabilities of the Luster Machine Shop and Railway Equipment Co., Philadelphia. Fairbanks-Morse have opened a new branch at this address under the management of Mr. D. W. Dunn.

Pacific Coast Office Established —

The Starr Brass Works, manufacturers of the "Sprarite" spray cooling systems, Chicago, Ill., announce a Pacific Coast office in the Rialto Building, San Francisco.

Electric Furnace Installation

Robert L. Rockwell, consulting engineer of Seattle, has recently completed plans and specifications for a modern electric steel furnace installation for the new foundry of the Deud-MacFarlane Machinery Co., Tacoma, Washington.

Radio Specialties to be Produced in New Shop —

With the perfection of radio telephones has come an increase in demand for delicate electrical instruments. This demand is being met by the Western Electric Company, the oldest manufacturers of telephone equipment in the world, by the establishment of a factory at Philadelphia where instruments of extreme sensitiveness are made.

Meeting Notices for Electrical Men

(Preliminary plans for the 1921 Pacific Coast Section N. E. L. A. Convention are announced below, along with the report of the recent Executive Committee meeting. Industrial illumination is prominent among the subjects discussed at the various engineers' meetings and important organization news is included in recent Northwest meeting reports.—The Editor.)

N. E. L. A. Executive Committee Decides Convention Date

The meeting of the Executive Committee of the Pacific Coast Section, N. E. L. A., decided that the annual convention of the Pacific Coast Section N. E. L. A. should be held at Del Monte, May 25th to 27th inclusive, and that free copies of the "Electrifier" should be sent out between the present time and the date of the convention. The question of the finances of the Pacific Coast Section was discussed and plans were made to carry on the work of the Pacific Coast Section until the first of the year, when it could expect financial help from the national body.

Mr. Robert Sibley, editor of the Journal of Electricity, was elected to serve on the Executive Committee in place of Mr. W. M. Deming, who has resigned from the technical press and moved to Tennessee. Lee H. Newbert, division manager, East Bay Division, Pacific Gas & Electric Company, as president of the Pacific Coast Section is chairman of the committee. The other members are:

Wm. Baurhyte, vice-president Los Angeles Gas & Elec. Corp., Los Angeles; S. J. Lisberger, chief of division of electric distribution and steam engineering, Pacific Gas & Electric Co.; A. H. Halloran, Pacific Coast Dept. McGraw-Hill Book Co.; E. B. Criddle, general agent, Southern Sierras Power Co., Riverside; A. B. West, vice-president and general manager, Southern Sierras Power Co.; Henry Bostwick, Pacific Gas & Electric Co.; R. E. Fisher, manager commercial department, Pacific Gas & Electric Co.; S. H. Taylor, Electric Railway & Manufacturers' Supply Co., San Francisco; J. B. Black, general sales manager, Great Western Power Co., San Francisco; A. G. Wishon, general manager, San Joaquin Light & Power Corp.; D. E. Harris, Pacific States Electric Co., San Francisco; R. A. Balzari, manager industrial division, Westinghouse Electric & Manufacturing Co.; J. A. Britton, vice-president and general manager, Pacific Gas & Electric Co., and W. M. Shepard, commercial manager, California-Oregon Power Co., San Francisco.

Scientific Illumination and Northwest Development Discussed Before Joint Meeting at Portland

A paper on "Scientific Illumination and Its Practical Applications" was presented by F. H. Murphy, illuminating engineer, of the Portland Railway, Light & Power Company, before a recent joint meeting of the Portland Sections, A. I. E. E., N. E. L. A. and Contractor-Dealers.

The paper dealt with the theory of radiant energy, the complexity of the structure of the eye and the construction and efficiency of the modern incandescent lamp. Following the presentation of this paper, the conditions which obtain in the average poorly lighted machine shop in contrast to those which may be found in a modern well lighted industrial plant, were shown by a lighting exhibit installed especially for the occasion. So much enthusiasm has been stirred up that there is a movement under way to establish a permanent lighting exhibit.

G. E. Armstrong, Pacific Coast editor of the Electrical World, who has been spending some time in New York and

has just completed a tour of the Northwest, gave a most interesting talk at the "Northwest Development" meeting held November 23. He said that the Northwest, and Portland in particular, has suffered less business depression than most any other section. Mr. Armstrong attributes present conditions to the consumers' strike, no foreign markets, holding of agricultural products and the unemployment of labor. He feels optimistic over industrial development and the growth of the electrical industry in the Northwest, and advocates inter-connection of power systems as a solution to the economic development of the water power in this section.

Future programs planned are: "Electrical Engineering Progress in the West," by Robert Sibley, "Water Power Development," by Franklin T. Griffith, and "Public Utility Financing," by Geo. L. Myers.

Los Angeles Section, A. I. E. E.

With a record-breaking attendance the Los Angeles Section of the American Institute of Electrical Engineers put over the second big meeting of the year on the evening of November 23. Addresses were given by H. A. Barre, executive engineer for Southern California Edison Company, and R. C. Starr, construction engineer for the San Joaquin Light & Power Corporation.

Mr. Barre's subject was "The Edison Plan—an Adventure in Democracy." After an introduction outlining the physical and financial features of the Edison power program at Big Creek, Mr. Barre discussed what he termed the "human plan." He mentioned the Reward for Efficiency idea as advanced by

Commissioner Edgerton at the Pasadena convention and showed how great operating records could be made by a company adopting such an idea as an incentive to its employees to do their best at all times.

Mr. Starr's subject was "The Kerckhoff Power Development." According to his statements, this is the first unit of the greater San Joaquin plan, which contemplates the development of new hydroelectric plants at the rate of 30,000 horsepower a year for the next five years, and then at the rate of 50,000 horsepower annually for the succeeding five years. Most of this will be on the Kings River.

BUILDERS OF THE WEST — XCI



ARTHUR P. DAVIS

The reclamation policy of the United States Government has made possible the development of immensely fertile areas in the West through vast irrigation projects carried out on a scale impossible to private enterprise and with a vision and daring which have resulted in the breaking of more than one world's record in engineering achievement. To Arthur P. Davis, director and chief engineer of the U. S. Reclamation Service and president of the American Society of Civil Engineers, this issue of the Journal of Electricity is affectionately dedicated in acknowledgment alike of his personal achievements in Western engineering and of his constructive work in directing this building of an empire from the arid West.

DO YOU REMEMBER

—in 1898 when wireless telegraphy was demonstrated at the Trans-Mississippi Exposition at Omaha—and there was doubt whether Marconi should be given credit for the invention?

Oregon Contractors and Dealers to Organize Branch in Salem

A meeting was held in Salem on December 7 for the purpose of organizing an active branch in the third district of the Oregon Association of Electrical Contractors and Dealers, at which time district officers and a representative to serve on the executive committee of the State Association was elected.

F. S. Barton was elected district representative on the State Executive Committee. The members of the District Executive Committee were elected as follows: J. H. Ralston, Albany, W. G. Cummings, Corvallis, W. H. Welch, Salem, and F. B. West, Dallas.

At the annual convention of the State Association held in Portland in October, it was decided to re-district the state, making seven districts instead of three as heretofore, and plans are now under way to establish active branches in the six districts outside of Portland, in order that the members in the various districts may have the benefits of district meetings, which make for better cooperation and which will facilitate the work of the Northwest Electric Service League. It is planned to organize the other districts within the next two months.

The district chairman and secretary will be elected at the first meeting of the Executive Committee.

Denver A. I. E. E. Visits Sugar Plant

The workings of electric power in the manufacture of sugar were studied by the members of the Denver Section, American Institute of Electrical Engineers, on the afternoon of December 11 when they visited the Brighton Plant of the Great Western Sugar Company. After the trip a dinner was given at the Metropole Hotel and B. Hutchins, traveling superintendent for the Great Western Sugar Company, gave a very interesting address.

Industrial Illumination Presented by Illuminating Engineering Society

"The What and Why of Industrial Illumination" is the title of the address being presented by Otis L. Johnson at the December 15 meeting of the San Francisco Bay Chapter of the Illuminating Engineering Society. Mr. Johnson is illuminating engineer for the Benjamin Electric Manufacturing Company, Chicago, and national vice-president of the Illuminating Engineering Society. Invitations to this meeting have been extended to the American Institute of Electrical Engineers, American Society of Mechanical Engineers, American Institute of Architects, San Francisco Society of Architects and the American Association of Engineers.

Hydroelectric Development Is Subject of Joint A. A. of E. and Commercial Club Meeting in Fresno

At a November meeting the Fresno branch of the American Association of Engineers held open house with the Commercial Club. Mr. E. C. Smith, president of the branch, introduced the speakers and explained the purpose and ideals of the association for the benefit of the general public in attendance.

Rex C. Starr, construction engineer with the San Joaquin Light & Power Corporation, spoke on recent hydroelectric developments, illustrating his talk with slides showing the construction of the Kerckhoff dam and power house.

B. F. Jacobsen, designing engineer with the San Joaquin Light & Power Corporation, gave a short talk concerning the advantage of developing hydroelectric rather than any other kind of power. He said that, unlike other means of power generation, the power in our streams is being created anew every year, and when we use it we are not drawing upon any limited supply.

This meeting was another of the important steps being taken to make the story of hydroelectric development particularly understood.

Committee Appointed by N. E. L. A. Public Policy Committee

At a recent meeting of the Public Policy Committee of the National Electric Light Association all activities of the Association were reported upon, discussed and approved. Financial matters were discussed, and Chairman McCall of the Finance Committee reported that satisfactory arrangements had been made to carry on the work of the Association pending receipt of the new dues in 1921.

President Insull of the Association was authorized to appoint a committee to cooperate with other public utilities in presenting public policy matters to the public.

Chairman Mitchell was authorized to appoint a committee to represent the N. E. L. A. at the Washington convention of the National Association of Railway Utilities Commissioners. The ex-officio members of this committee were designated as Chairman Mitchell, President Insull and Executive Manager Aylesworth.

In the afternoon representative bankers, investment bankers, manufacturers, business men and representatives of the American Gas Association and the American Electric Railway Association attended an open meeting of the Public Policy Committee, at which time all phases of the present public utility situation were discussed.

Northwest Electrical Service League Appoints Finance Committee

At a meeting of the Advisory Committee of the Northwest Service League, held in Seattle November 29, a committee to finance the work of the League was appointed, consisting of:

F. N. Averill, Fobes Supply Company, Portland, chairman; A. S. Moody, General Electric Company, Portland; L. A. Lewis, Washington Water Power Company, Spokane; John V. Strange, Pacific Power and Light Company, Portland, and A. J. Gladson, contractor-dealer, Yakima, Washington.

This committee will immediately set out to raise funds for the conduct of the work of the League for the year 1921.

San Francisco Electrical Development League Holds Joint Meeting with Purchasing Agents

The November 22 meeting of the San Francisco Electrical Development League was in conjunction with the Purchasing Agents' Association. The speaker of the day was Mr. G. B. Gray, the chairman of the Purchasing Agents' Association, who spoke briefly on the importance of the purchasing agent and the necessity for good judgment on his part. R. A. Balzari, manager of the power department, Westinghouse Electric & Manufacturing Company, told of impressions received while on a visit in the East. He stated that labor is becoming more efficient, this being noticeable in a certain factory which wished to cut production and so dropped two hundred girls. Instead of the production dropping off, it remained at the same point. The next speaker was D. W. Stands, purchasing agent of the California Central Creameries, who summed up general business conditions by stating that the trend of prices is now toward a lower level and that while the buyers are hesitating to buy on the declining market and the manufacturers are needing the money, something must happen. He compared the present business conditions to a log jam and stated that in all probabilities a crash is imminent, but that the majority of businesses which are built upon safe and sane lines will not be hurt. E. O. Shreve, local manager of the General Electric Company, was the last speaker, and emphasized especially that the prosperity of industry is dependent upon the prosperity of the central station, and that the power shortage which existed in California during the past season was not the only power shortage in the country, as some of the eastern central stations are struggling with a power shortage because of lack of money with which to finance extensions. Mr. Shreve finished his

talk by telling of the hopeful outlook for the electric railways at the present time. They are at last being put on a sound basis by the action of the central station commissions which have come to recognize their problems.

Northwest Electrical Service League Discussed at Spokane Meeting

The electrical industry of Spokane and Eastern Washington was well represented at a dinner meeting held at the Spokane Hotel on the evening of December 2, to listen to a discussion of the objects and plans of the Northwestern Electrical Service League. One hundred and twenty-five were present.

Mr. W. E. Coman, vice-president and general manager of the Washington Water Power Company, presided at the meeting, and said that his company was very glad to cooperate in this movement and lend its moral and financial support to the League.

Various phases of the League's program were discussed by:

L. A. Lewis, Washington Water Power Company; R. W. Clark, Puget Sound Power and Light Company, chairman of the Advisory Committee of the League; John V. Strange, Pacific Power and Light Company; J. I. Colwell, Western Electric Company, Seattle; Harry Byrne, North Coast Electric Company, Seattle; A. J. Gladson, contractor-dealer, Yakima; W. M. Meacham, contractor-dealer, Seattle; S. C. Jaggar and J. R. Tomlinson, contractor-dealers, Portland; and A. C. McMicken, Portland Railway, Light and Power Company, Portland.

Future A. I. E. E. Meetings

At its meeting in Philadelphia, October 8, the Meetings and Papers Committee arranged for this season's Institute meetings as follows:

November meeting, Chicago; January meeting, Cleveland; February, Midwinter Convention, New York; March meeting, New York; April meeting, Pittsburgh; May, Annual Meeting, New York; June, Annual Convention, Salt Lake City.

Record Growth of California Industries Association

At a recent meeting of the board of directors of the California Industries Association, President James H. McDonough announced that thirty-one new members had joined the association during the preceding ten days. This was the largest membership gain ever made by the association in a similar period of time. The membership is made up of companies or firms rather than individuals.

San Francisco A. A. of E. Elects New Officers and Visits Pacific Railway Club Meeting

On December 7 the new officers of the San Francisco Chapter of the American Association of Engineers were elected as follows:

President, G. C. Brown, chief mining engineer, California Industrial Accident Commission; treasurer, F. J. Amweg, consulting engineer, San Francisco; secretary, R. E. Dodge, office engineer, San Francisco division, California State Highway Commission; first vice-president, L. D. Howland, sales engineer, C. C. Moore & Co.; second vice-president, W. H. Phelps, assistant division engineer, Southern Pacific Company.

After the business meeting the members adjourned to the Commercial Club where they were the guests of the Pacific Railway Club. A talk on "Track Maintenance" was given by W. H. Kirkbride, engineer of maintenance of way and structures for the Southern Pacific Company, and one on "The Use of Motor Cars in Track Maintenance Work" by Stephen Smith of the Fairbanks-Morse Company. Both talks were illustrated by lantern slides.

Development League Hears Talk on Europe

"Europe Through American Eyes" was the subject presented to the San Francisco Electrical Development League at its regular meeting in the Palace Hotel on November the twenty-ninth, at which time a subscription list for the starving children of Vienna was started. The chairman of the day was Mr. A. H. Halloran, Pacific Coast representative of the McGraw-Hill Book Company, who introduced the speaker

COMING CONVENTIONS

CALIFORNIA ASSOCIATION ELECTRICAL CONTRACTORS AND DEALERS

Quarterly Meeting—Stockton, Cal., Jan 22, 1921

PACIFIC COAST SECTION, NATIONAL ELECTRIC LIGHT ASSOCIATION

Annual Convention—Del Monte, California, May 25-27, 1921

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS

Annual Convention—Salt Lake City, Utah, June 20-26, 1921

of the day, Mr. W. V. Woehlke, secretary-treasurer of the Sunset Publishing Company, telling of his reputation as a careful student of economics.

Mr. Woehlke told of his trip through Europe and spoke particularly of conditions as he found them in the Central Empire. Europe has urgent need of all our surplus products, Mr. Woehlke stated, but due to the war time conditions still existing there and the present rate of exchange Europe cannot afford to pay the premium which the United States demands for its excess material. Mr. Woehlke stated that in the Central Powers the labor costs are very high, having risen from five hundred to eight hundred per cent, and that the purchasing power of the money in those countries is only one-twelfth of what it was in pre-war days. Consequently, there is from sixteen to thirty-five per cent reduction in consumption. Bolshevism does not interest the laboring man of Europe at the present time. He only wants to work and get back to the 1914 standard of living. Mr. Woehlke said that the infant mortality in Vienna is two hundred and seventy-four out of every thousand for children under five years of age, or nineteen times greater than that of New York City. He finished his speech by stating that the people of Europe have faith in the power of the United States to clean up all the petty jealousies that exist there and to determine the correct boundaries and relations between European countries, and that what we need at this time is a foreign policy with a backbone.

At the conclusion of Mr. Woehlke's talk H. F. Jackson, general manager of the Great Western Power Company, announced that he wanted to start a subscription list for the starving children of Vienna and that all the money so raised be sent to the Hoover Food Commission from the San Francisco Electrical Development League. Inside of seven minutes over \$1,000 was raised and the San Francisco Electrical Development League is conducting a campaign, hoping to swell this amount before sending on the check.

Scientific Advertising Presented to Oregon Association of Electrical Contractors and Dealers

The regular bi-monthly meeting of the first district, Oregon Association of Electrical Contractors and Dealers, was held Monday evening, November 22.

In pursuance with the association's new policy of having one of its members present a paper at each of the meetings, Mr. C. P. Scott, of the Scott Electric Company, presented a very interesting and instructive paper on "Scientific Advertising."

Plans were laid to run three pages of cooperative Christmas advertising in one of the local papers between now and Christmas, to better sell the public on the electrical Christmas idea and to induce them to patronize the electrical specialty shop. If this advertising proves successful it is planned to carry it on during the year 1921.

DO YOU REMEMBER

—in 1896 when electric cars were first run out to the beach in San Francisco, supplanting the steam line?

LATEST IN EVERYTHING ELECTRICAL

(The ever increasing popularity of electric welding in Western states makes the announcement of a new portable welding outfit, which appears on this page, especially significant. The industrial engineer will be interested in the new line of controllers announced here and also in the new battery charger. A new ironer and a portable motor are presented for the benefit of the electrical dealer.—The Editor.)

PORTABLE WELDING OUTFIT

The General Electric Company has developed an electric arc welding equipment which is said to be especially



The new portable outfit for electric welding

adapted to welding rail bonds on street or industrial railways.

The apparatus consists of a wire resistance unit, mounted in a light metal frame, with suitable leads for connecting to the power supply circuits and to the electrode holder. Switches provide a welding current with range of from 60 to 200 amperes, in 15-amp. steps.

The circuit is controlled through a contactor, operated by means of a push-button switch located close to the electrode holder.

NEW BATTERY CHARGER

The Valley Electric Company is placing a new device, the Type MS Rectifier, on the market, believing that it will answer the demand for a simple and dependable charging system which



Principal parts of the MS Rectifier. Diagram of the workings of the device.

has been created by the increasing use of electrical signal systems.

The base contains a small transformer with a set of taps for different voltage batteries. The transformer is designed for low iron losses and built of the best silicon transformer sheet steel. The complete transformer is soaked in a baking varnish and baked so as to be water-proof.

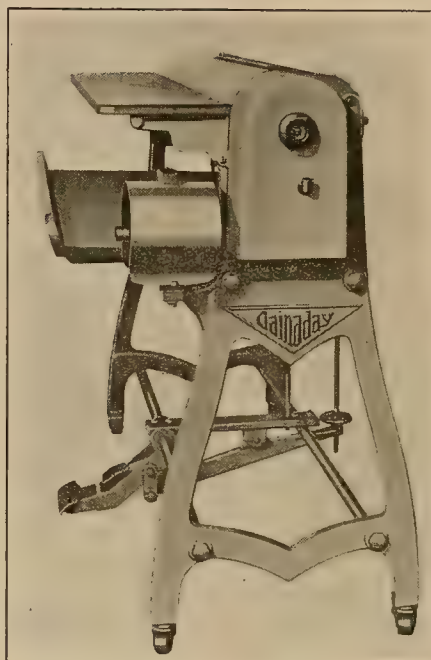
The rectifying movement proper is mounted on a slate base and has two rows of binding posts, one set of which connects to the transformer and the other set to the battery terminals.

NEW POWER IRONER

The Gainaday Ironer, being placed on the market by the Pittsburgh Gage & Supply Company, Pittsburgh, Pa., is electrically operated and heats by gas.

It is made in 42-in., 46-in. and 50-in. roll widths, is direct motor-driven and foot-controlled, and can be operated while sitting down. The gear mechanism is completely enclosed.

The manufacturer states that the motor carries a strong load, and is located



The new Gainaday Ironer

on the side, within easy reach of the operator. Also that an especial advantage of the ironer is its center gas-feed which automatically distributes an even heat over the whole ironing shoe.

RENEWABLE PLUG FUSE

The Pierce Fuse Corporation of Buffalo, N. Y., announce their new renewable plug fuse as being exceedingly simple and easy to renew. It consists of three parts—a porcelain core, a porcelain case with the brass plug-shell attached, and the link of which the brass plug-end contact disc is a part.

To renew the Pierce plug fuse, it is necessary only to unscrew the core from the case, pull out the blown link, slip in a refill and screw back the case. Contact is made by bending the link over so that as the plug is put together, the link is engaged between the core and the brass shell of the case and held tight.

REGULATOR FOR CONTROLLING LINE VOLTAGE

The American Galco, Inc., Grand Central Place, New York, has developed a new device for regulating the line volt-

age, motor-starting current, arc furnace current, and so forth. The action is controlled by the varying pressure in a stream of water constantly flowing through a pipe.

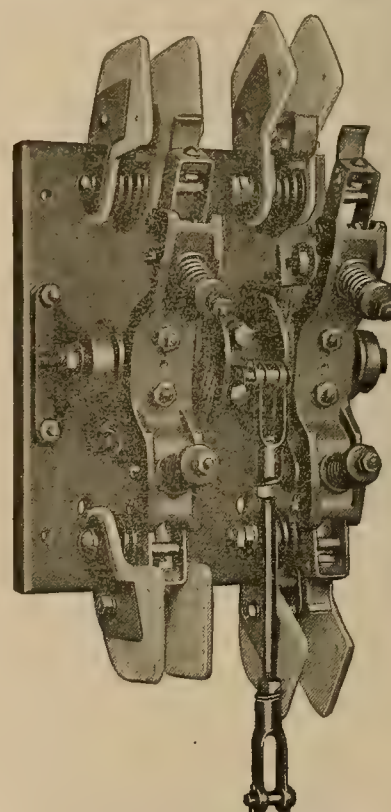
NEW ELECTRIC RIVET HEATER

The electric rivet heater which is being placed on the market by the Taylor Welder Company, Warren, Ohio, is built in sizes to heat two rivets at a time. The equipment consists of a 15-kw. transformer and a five-step self-contained regulator for controlling heat and rivet adjustment. The complete outfit weighs about 400 lb., occupies 31 in. by 18-in. space and is 40 in. high.

A NEW CLAPPER-TYPE CONTROLLER

The Allen-Bradley Company of Milwaukee, Wisconsin, announce a new line of mill, crane and hoist controllers. This controller, made in sizes ranging from 1 hp. to 150 hp., is known as the "clapper-type controller," primarily because all switching and contact-making is done with a clapper-switch contactor.

The manufacturers state that the controller is simplified by the use of the Allen-Bradley graphite compression resistor, mounted within the controller, so



Clapper contactor unit for controllers ranging from twenty to ninety horsepower

as to avoid the use of grids or wire-wound resistors and the need of step contacts.

UTILITY MOTOR MOUNTED ON TRIPOD BASE

For use on farms and other places supplied with 32-volt energy, the Westinghouse Electric & Manufacturing Co., East Pittsburgh, has just placed on the market a $\frac{1}{4}$ -hp. electric power stand.



The portable motor which makes it possible to obtain power as well as light from the farm lighting plant.

The $\frac{1}{4}$ -hp., 32-volt motor is mounted on a substantial tripod base. A telescopic rod is provided to brace the motor and to obtain the proper tension for the belt. The rod is secured on one end through convenient holes provided in the base and the motor frame.

The main shaft speed is 2100 r.p.m. and the back geared shaft turns at 250 r.p.m. There are two pulleys on each shaft, a $\frac{6}{8}$ -in. flat pulley and a $2\frac{3}{4}$ -in. grooved pulley being permanently attached to the slow speed shaft. Grindstone, feed cutter, root cutter, water pump, horse clippers, farming mill, clothes washer, cream separator, butter churn, sausage grinder, and ice cream freezer are among the devices which can be run by this motor.

NEW LIGHTING DEVICES

A number of new devices have just been placed on the market by Harvey Hubbell, Inc., of Bridgeport, Conn.



On the right is a new surface switch, in the center is a new type attachment plug, while to the left is a pull socket with luminous acorn.

Among them is the new Toggle Surface Switch which is manipulated by the throwing of a lever rather than by the turning of a key or button. The manufacturer states that this surface switch allows the switch to be made more attractive and stronger than the ordinary one, that manipulation is more convenient and that the switch is self-indicating.

The so-called Composition Attachment Plug with a bayonet base is designed for 6 amperes—250 volts. The Luminous Acorn attached to various pull devices is also being presented.

Books and Bulletins

The Holophane Datalog

A complete engineering handbook on illumination as well as a catalog of products has been recently published by the Holophane Glass Company, Inc., New York, under the name of the Holophane Datalog.

Publication on Illumination

The illumination engineer will be interested in Scientific Paper No. 391 of the Bureau of Standards entitled "The Measurement of Disuse Reflection Factors, and A New Absolute Reflectometer."

Report of Smithsonian Institution

The annual report of the Board of Regents of the Smithsonian Institution for the year 1918 has recently been published. This shows the operation, expenditures and condition of the institution for the year ending June 30, 1918.

Bureau of Mines

The third of a series of yearly petroleum bibliographies has recently been published by the Bureau of Mines. The two preceding, Bulletin 149 and Bulletin 165, were for the years 1915 and 1916. This Bulletin 180, by E. H. Burroughs, is for 1917.

Insulated Wire Cable Handbook

The Okonite Company has published a book which is a complete handbook on its extensive line of insulated wire and cable. All the parts of the factory as well as the various types of wire and cable are shown in the numerous illustrations.

Hydroelectric Companies

The October 30 issue of "The Magazine of Wall Street" contains an interesting article under the above title pointing out some of the advantages of water power companies and their vast future possibilities. In the article, two companies whose power resources are largely hydro are reviewed.

Making Panel Board History

An interesting folder under this title is being distributed by the Benjamin Electric Manufacturing Co. in connection with their publicity campaign on the Benjamin-Starrett Panel Board line. Complete illustrations and descriptions of the various types and sizes are attractively given.

Fort Wayne Electric Rock Drill

The Rock Drill Department of the General Electric Company at Fort Wayne, Indiana, has published an unusually attractive booklet which presents the structure and usage of the Type "A" drill which has been successfully used in large mines, railroad tunnels and in quarries.

Fan Booklet for the Dealer

The Robbins & Myers Company of Springfield, Ohio, is distributing a booklet entitled "Putting Your Fans on the Profit Side of the Counter" and the electrical dealer is told how to do so. Four leaflets designed for local distribution are included with directions for ordering same. A number of examples of the newspaper advertising which the manufacturer will supply are also given.

Bureau of Standards

Quantitative data on the color and spectral distribution of energy of some modern searchlight arcs and spectroscopic analysis of the carbons is given in the late publication of the Bureau of Standards, Technologic Paper No. 108, under the title: "Color and Spectral Composition of Certain High-Intensity Searchlight Arcs." Methods of measurement are also described herein.

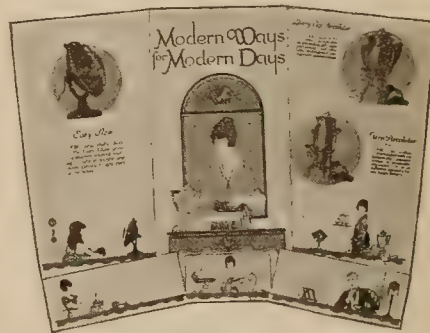
Booklet on Cleaners and Vibrators

"Royal Breezes" is the title of a new monthly dealer-help booklet edited by Frank B. Rae, Jr. for the P. A. Geier Company of Cleveland, in the interests of jobbers, dealers and salesmen who handle Royal cleaners and vibrators.

The November issue contains an especially interesting article on the various types of rugs and instructions regarding their cleaning and care.

Modern Ways for Modern Days

The most frivolous bride will read the story of the electrical appliance as



The new Westinghouse Booklet

it is told in the latest Westinghouse Electric & Manufacturing Co. booklet. Only seven tiny lines appear on each page accompanying an artistic picture of the appliance and finished off with a sketch of the appliance in use.

Electric Drive for Cotton Openers and Pickers

The Westinghouse Electric & Manufacturing Company has issued Leaflet 1910 which describes and illustrates "Electric Drive for Cotton Openers and Pickers." The different methods of drive are given with a table for calculating the size of motor for group drive. Motors and starting apparatus for this equipment are also described and illustrated.

Electric Heating of Air

The Cutler-Hammer Manufacturing Company, Milwaukee, Wis., have recently published a leaflet for the purpose of describing the Convectory type Electric Air Heaters. The leaflet also tells briefly the advantages of electric heat over other forms of heating and gives thumb rules which enable the customer to closely estimate the number or size of meters required for any particular installation.

"Do-It-Electrically" Bulletin

A recent publication of the Philadelphia Electric Company sets forth in a most attractive manner the joy and practicability of "doing it all electrically." The several chapters are: Electrifying Housework's Biggest Job—Dishwashing; Electric Bread; Home-making, a New-Old Profession; Cold; A Bolshevik Motor?; and Make Your Electric Fan Work for You.

NEW ELECTRICAL DEVELOPMENTS

(Announcements of new projects which involve the development of considerable hydroelectric power are made in the Northwest. Power companies of the Central District are constructing new substations and planning various other system enlargements. Interesting Commission rulings are reported from both the Southwest and Intermountain regions.—The Editor.)

THE PACIFIC NORTHWEST

SAMS VALLEY, ORE.—The Sams Valley Power Company has been incorporated here, with Metla Pelton, president. The company will distribute electric energy.

ALBANY, ORE.—A new industry for Albany has been announced by the M. C. Morgan Manufacturing Company, who plan to manufacture food flavoring, washing powders, polishes, cleaners and similar household materials.

ILWACO, WASH.—This city is considering the purchase of the distribution system of the North Shore Light & Power Company, and the installation of a 1,000-kw. generating plant. If an agreement can be reached, the lines will be taken over immediately.

SEATTLE, WASH.—Plans and specifications for the architectural work in connection with the construction of the 10-story main building of the Pacific Telephone & Telegraph Company have been completed. The value of the work has been placed at \$950,000.

HOQUIAM, WASH.—The city council has rejected the only bid submitted for installation and maintenance of a boulevard lighting system for the business section of the city. The Grays Harbor Railway & Light Company submitted the bid. New bids will be called at once.

YAKIMA, WASH.—The Pacific Power & Light Company is spending \$75,000 this fall in improvements on its substations and transmission lines to increase its facilities to meet the very urgent demand for increased service in the Yakima Valley territory served by the company.

SALEM, ORE.—The Mount Reuben Mining Company of Grants Pass has made application to the state engineer for the appropriation of water from Reuben Creek in Josephine county for the development of 87 hp., to be used for power purposes in connection with a mining project.

SEATTLE, WASH.—Work on the \$9,000,000 Skagit hydroelectric power development has been reduced about 75 per cent and may be forced to suspend entirely next month unless money is obtained by the city to continue its operations. Several millions in bonds remain available, but are useless until they are sold.

SEATTLE, WASH.—The Pacific Coal Company, Smith Building, has presented to the county commissioners of King county a petition for a franchise to construct and maintain a power line to carry 13,000 volts from the Hyde Mine to beyond the town of Black Diamond. Hearing was set for December 13.

SEATTLE, WASH.—Mayor Hugh M. Caldwell and the city council are seeking the assistance and cooperation of Seattle bankers and bond men in marketing the Skagit River power bonds, to enable the continuation of work in the upper Skagit Valley, and to furnish between \$2,000,000 and \$3,000,000 for work next year.

BEND, ORE.—Ground has been broken for the erection of a new telephone exchange for the Pacific Telephone & Telegraph Company, which will house a five-section board at present, with capacity for the ultimate installation of a ten-section board which will take care of the needs of a city of 12,000 population.

SPOKANE, WASH.—The \$200,000 addition to the plant of the Inland Empire Paper Company at Millwood, the construction of which has been in progress since spring, will be completed about December 1, it has been announced by Stanley G. Rosebush, president of the company.

A 1200-hp. synchronous motor to drive additional grinders will be installed.

SILVERTON, ORE.—Erection of a pulp mill to be operated in connection with the lumber plants of the Silver Falls Timber Company at Silverton, has been announced. By-products of the sawmills of the Silverton company will be ground at pulp plant and shipped to the various paper mills of the Pacific Northwest to be converted into the finished product.

PORTLAND, ORE.—The Clackamas Power & Irrigation Company of Portland has filed an application for a permit to appropriate 1,000 second-feet of water from Clackamas river, from which 11,705 horsepower will be developed by a hydroelectric generating plant. The total cost of the project is estimated at \$1,250,000, construction work to be started within one year from grant of permit.

KLAMATH, ORE.—Senator Chamberlain and Representative Sinnott of Oregon appeared before Secretary Payne Dec. 2 as representatives of the water users of the Klamath (Ore.) reclamation project to ask cancellation of the contract with the California and Oregon Power Company for construction of a dam at the head of Klamath Lake, free of cost to the government. Failing cancellation, they recommended various amendments, calculated to protect the water users.

MARSHFIELD, ORE.—In line with a movement for a larger capacity power and electric plant at Bandon, with a dam on Willow Creek, in Curry county, and a transmission line 20 miles to Bandon, the Bandon Power Company has submitted to the city council a price of \$35,000 for its plant, including buildings, distribution system and all machinery. Engineers had estimated the probable cost of the new system at \$105,000, including the Bandon Power Company's holdings at a price of \$25,000.

SPOKANE, WASH.—Interest was revived recently in the huge hydroelectric project proposed at Lake Chelan by the Great Northern Railroad. The dam when constructed will raise the lake 12 feet and furnish a steady head of water for a generating plant capable of supplying an area of 200 miles with electric current. For immediate relief in the electrical and water supply for the city of Chelan, the company will enlarge the city water-mains and put in a new gasoline auxiliary engine at a cost of \$25,000.

KLAMATH FALLS.—The main point of the findings of the special committee of the Chamber of Commerce, which has been conducting the hearing in the dispute of the American Legion and the California-Oregon Power Company on the Upper Klamath Lake storage question, is that the California-Oregon Power Company is acting merely as an agent of the United States Government and has not acquired, under its 1917 contract for building the Link River Dam, any rights to the waters of the Upper Klamath Lake or its tributaries.

STAVE FALLS, B. C.—It is reported that the Western Canada Power Company plans to raise the present level of the storage dam at Stave Falls, by another fifteen feet, to meet increasing demands for the generation of electric current. The additional water storage thus created would allow of the installation of another electrical unit in the company's power house of at least 13,000 horsepower capacity. It is roughly estimated that the additions to the power plant will cost \$200,000.

THE PACIFIC CENTRAL DISTRICT

OAKLAND, CAL.—By December 15 the School Department will have under construction or will have contracted for \$450,000 worth of new schools under the \$5,000,000 building program, according to the chief of construction.

REDDING, CAL.—The Pacific Gas and Electric company has enlarged the Shasta Power district to include all of Shasta county and the northern portion of Tehama county and placed G. R. Milford in charge.

RICHMOND, CAL.—The Santa Fe foundry is manufacturing 700-pound projectiles on a contract from the War Department. As fast as the projectiles are manufactured they are being shipped to government loading stations.

COLOMA, CAL.—Two more of the thirty local farmers are installing more motor power on the farms. Homer Metcalfe of Coloma and Frank Wagner of Lotus have placed orders for power spray pumps for their orchards.

DOWNIEVILLE, CAL.—Thomas and Leo Bessler are preparing to build a five-stamp quartz mill on their property in Downieville. A fall of something like 90 feet can be obtained, which will be ample for all the water power needed.

CHICO, CAL.—The new Sperry rice mill at Chico began operating November 22 and will have an output of 2400 sacks or six carloads of finished rice daily during the season. The mill represents an investment of \$300,000 by the Sperry Flour Company.

REDDING, CAL.—The Pit River Power Company has made an application to the Federal Water Commission in Washington for a preliminary permit for power development on Pit river above Copper City. The Commission has fixed February 10 as the time for hearing.

FRESNO, CAL.—The San Joaquin Light and Power company will begin at once the erection of a power sub-station to cost \$15,000 on the James ranch colony, owned by Los Angeles and San Francisco capitalists, and on which has just been completed 50 miles of power lines.

RICHMOND, CAL.—Electroliers and lighting of Macdonald, Richmond and Washington avenues was discussed at a meeting of the council recently and it was voted to accept the contract of the Western States Gas & Electric Company, which will install the system under a ten-year contract.

WATSONVILLE, CAL.—According to communications received by Secretary E. C. Learock of the local chamber of commerce, the Granite Springs Estate company has under consideration the erection of a large dehydration plant in this city. It is said the company's assets are over \$1,800,000.

GRASS VALLEY, CAL.—The Pacific Gas and Electric Company has a large crew of men employed in the southeastern part of this county, increasing the capacity of the Drum power line, the medium for transporting electric energy to Sacramento and the Bay region. Three additional high power wires are being strung the entire length of the line.

LODI, CAL.—The annual report of the city clerk for the fiscal year ending June 30, 1920, shows the receipts from the municipal electric plant amounting to \$52,169.30, and the expense as \$32,100.31, leaving a profit of \$20,068.99. Out of this was paid \$1,925.33 on the bonds and \$8,367.56 in improving the plant. During the

year there has been an increase of 255 users of electricity.

SONORA, CAL.—Involving a \$2,000,000 power plant project, application for use of part of the natural flow of the Stanislaus river has been filed with the recorder of Tuolumne county. Application is made by Frank R. Pattee of Oakland and Samuel Bernhard of San Francisco, who contemplate the erection of a power plant at the headwaters of the river to develop about 9600 horsepower.

SAN JOAQUIN, CAL.—The San Joaquin Valley Farm Lands Company is extending their transmission lines to 22 miles. This will make a total of approximately 60 miles of transmission lines constructed on the James Ranch within the last year. These lines are soon to be taken over by the San Joaquin Light and Power Company which is now constructing a sub-station one mile north of this city.

RICHMOND, CAL.—George E. Sheldon, secretary of the Downtown Association of Oakland, wants Oakland and Richmond to join in installing electroliers. In a communication to the City Council he states that Oakland is about to install electroliers, and if the two cities could agree on the same type an order sufficient for all could be placed with the manufacturers and a great deal of money saved.

SAN FRANCISCO, CAL.—"With two utilities operating in a field the business of which justifies the operation of but one, the public cannot be expected to pay in rates charges that will yield to each utility a return on its investment," says the Railroad Commission in an opinion accompanying an order allowing the Goldberg Motor Boats and the Delta Transportation Company only a 25% increase in charges instead of the 100% and more increase asked for.

SAN FRANCISCO, CAL.—A recent order issued by the Railroad Commission authorizes the Great Western Power Company of California to issue \$1,500,000 of its general mortgage convertible 8 per cent gold bonds. Authorization is given the company to use \$969,927.38 to reimburse its treasury, the money subsequently to be used to pay in part for plant extensions. The balance of the proceeds of the bond sale is also to be used to defray construction costs.

FRESNO, CAL.—The proposed bond issue for the acquisition of the system of the Fresno Canal and Land Company by the Fresno Irrigation District will be for \$2,000,000, under the recommendations submitted to the board of directors by Engineer George L. Swendsen. Of this amount \$1,750,000 represents the purchase price of the holdings as agreed upon by the boards of directors of the two organizations, while the remainder is for the purpose of improvements. It is planned to hold the election in the district about January 15.

VALLEJO, CAL.—The annual report of Major General Lansing H. Beach, Chief of Army Engineers at Washington, shows that on July 1st, this year, there was an unexpected balance of the funds for improvement of San Pablo Bay and Mare Island Strait of \$394,169, with outstanding liabilities of \$18,667. The amount expended during the fiscal year for maintenance was \$70,322. With the funds available it is proposed to deepen the channel in San Pablo Bay and Mare Island Strait to a depth of thirty-five feet and a width of 500 feet, and dredge a turning basin on Mare Island Strait.

SACRAMENTO, CAL.—The plan of Government engineers to build four locks in the Sacramento River to raise the water table of the river to allow sufficient water for irrigation purposes in the Sacramento Valley, has recently been discussed in the offices of the Sacramento Valley Development Association. The locks would do away with the necessity of pumping water for irrigation. This, it was said, would save the sum of \$200,000 annually among irrigators on the west side of the valley in power alone. A like amount would probably be saved

by irrigationists on the east side. The maintenance charge would likewise be saved. The dam proposed by Captain Jarvis would cost approximately \$15,000,000. It would permit the reclamation of thousands of acres of salt marshes, which are now practically worthless. The development body plans to interest the Bay section in this project.

THE PACIFIC SOUTHWEST

SAN FERNANDO, CAL.—An arch dam 375 feet high is to be erected in Pacoima Canyon.

PASADENA, CAL.—Work will be started next week on the building of an addition to the Southern Pacific freight depot in this city.

LOS ANGELES, CAL.—The Los Angeles City Council is planning to petition for 5,000 government tents for temporary dwellings to relieve house congestion.

LONG BEACH, CAL.—Negotiations looking towards the erection of a modern business block and establishment of a bank at the corner of Broadway and Belmont avenue are in progress between Adam Wasem and a group of Des Moines, Ia., men.

LONG BEACH, CAL.—A four-story brick apartment house to be erected at a cost of \$190,000 is one of the latest building projects to be advanced in Long Beach. The site for the new building is on West Seaside boulevard and Neptune Place, near the Virginia Hotel.

PASADENA, CAL.—According to C. W. Koiner, general manager of the city light department, the first unit of a \$300,000 addition to the municipal lighting plant will be installed next summer. The proposed site has been purchased from the Pacific Gas & Electric Company, and a new building will be erected to house the enlarged plant.

LOS ANGELES, CAL.—An order issued by the Railroad Commission directs the Pacific Electric Railway Company, operating in various towns in southern California, to reduce practically all of its carload rates, applying on sand, gravel, crushed rock and other such materials, between points on its line. The decreases, which will run from 5 cents to 35 cents per ton, will become effective just as soon as the new tariff can be issued.

LOS ANGELES, CAL.—Ordering a dismissal of the complaint of the trustees of the city of Calipatria, Imperial county, against the Holton Power Company, the Railroad Commission found that the company was following the rules of the Commission in connection with the making of extensions and it must deny the request of the city officials for an order compelling the power company to make service extensions upon more favorable terms than now prevail. The city's request that the utility be compelled to supply certain consumers without payment of extension advance deposits, is denied by the Commission on the ground that such an order would result in discrimination.

THE INTER-MOUNTAIN DISTRICT

FARMINGTON, UTAH.—A new street lighting contract has been signed with the Utah Power & Light Company.

SALT LAKE CITY, UTAH.—Final approval has been given by the city commission of Salt Lake City to plans and specifications for the proposed new whiteway lighting districts.

ROUNDUP, MONT.—To the Inman-Bailey Electric Company of Roundup has been awarded the contract for the installation of an ornamental lighting system in the business and residence districts of Lavina.

LAVINA, MONT.—The city is planning the installation of a municipal lighting system, and C. A. Renshaw, engineer of Roundup, Mont., has been engaged to supervise the work. Wooden poles will be used.

OAKLEY, IDA.—The Idaho Power Company will begin at once the construction of a power line to Vipont. The new power line can be

tapped by the three other mines in the Vipont district to supply their needs.

BOULDER, COLO.—Improvements totaling about \$60,000 will probably be made in the Boulder street car service if the ordinance passed recently by the city council, increasing the fares, is adopted when it comes up for final hearing early in December.

BOISE, IDA.—The Asequia Mutual Electric Company has been organized, with Robert Carlson, Frank Carlson and L. Keithly, directors. The company will purchase electric energy from the U. S. Reclamation Service, and will serve the needs of its members at cost.

LIVINGSTON, MONT.—Business men of Clyde Park, Wilsall and the valley adjoining are taking steps toward building a line to supply light and power to the Shields Valley. J. R. Kaiserman, Livingston manager of the Montana Power Company, is investigating the situation.

PARK CITY, UTAH.—The power line by which the Utah Power & Light Company is to furnish electric service to the Woodlawn Mining Company, in the Big Cottonwood district, has just been completed, and extensive development work at that property is planned for the immediate future.

BRIGHAM CITY, UTAH.—Work has been done in preparing for the rebuilding of the municipal electric light plant. The dam site in the narrows at Mantua has been located and staked off and about a mile of the pipe line along the mountain side on the north side of the canyon has been surveyed.

FILLMORE, UTAH.—Preliminary plans are under way by the Telluride Power Company to extend its power line from Fillmore through the artesian well belt, on to McCormick and thence to Delta and other West Side towns. There is also some talk of running an electric inter-urban railway along the power line.

BOISE, IDA.—Articles of incorporation have been filed by The Asequia Mutual Electric Company, a non-profit, cooperative association which was formed in Minidoka county recently. This association has been formed for the purpose of purchasing electric energy from the United States Reclamation Service and distributing it without profit to its members.

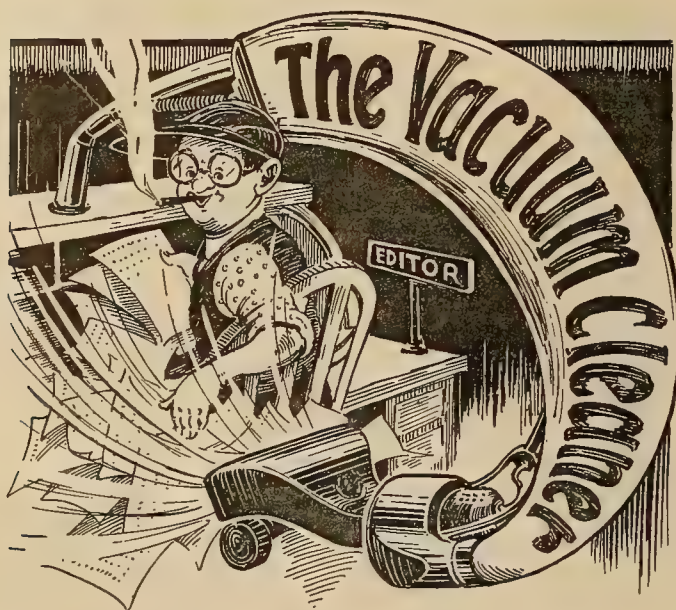
HYRUM CITY, UTAH.—According to a decision recently handed down by the Public Utilities Commission of Utah, the Hyrum City municipal electric plant must continue to furnish lighting service to its customers at the present rates, but may increase its rates for industrial power to 3½ cents within the city limits and to 5 cents outside the city limits.

PROVO, UTAH.—Articles of incorporation for the Goshen Valley Irrigation Company, which will irrigate 15,000 acres of land near Goshen, through an electrically operated pumping plant, have recently been filed. It is planned to install the first unit of this plant during the coming summer, which will be able to lift 100 second-foot of water 132 feet above the level of Utah Lake.

MANTI, UTAH.—The city's power plant, which has been undergoing rebuilding and repairs, including the installation of a new Pelton water wheel, has been again placed in operation. The installation of the new wheel has resulted in gained efficiency of 30 per cent, which together with the efficiency gained in the use of a direct drive rather than the old belt drive, and the new and modern machinery, means a total gain of from 75 to 100 per cent in efficiency.

INDEX

The index to Volume 45 of the Journal of Electricity, July-December, 1920, will be ready at the end of the month, and will be mailed to subscribers upon application.



YOU SHOULD BE THANKFUL —

That only 98 per cent of the population has decided to "do its Christmas shopping early."

That people don't put up umbrellas in the elevator.

That the man in front of you on the street car didn't turn over his newspaper before you finished reading about the murder.

That the person ahead of you stepped on the piece of chewing gum in your path.

That you don't own a farm and have to be always bothering about the weather.

That the Sunday edition of the newspaper comes out only once a week.

That your salary isn't high enough to necessitate your paying income tax.

That you are in no danger of being president for at least four years.

That you don't have to read the Annual Report of anything all the way through.

That it's still safe to cross the street in the suburbs.

That you don't own an automobile and have to worry over the price of gasoline.

That swearing isn't illegal yet, except over the telephone.

That some of your nieces and nephews were born so close to Christmas time that you don't have to buy more than one present.

That you don't have to write this page.

* * *

Building public opinion is supposed to be one of the functions of the press, but occasionally the printed page is a snare and a delusion. Witness the story of the irate man who burst into the editor's office demanding a correction of an item which had appeared.

"If the item was wrong," the editor smoothly replied, "we shall cheerfully do as you request."

"I told one of your reporters I saw a beautiful goldfinch perched on a twig just outside of my bedroom——"

"Well,——"

"And when the item came out in the paper it read 'goldfish.'"

"That isn't so bad."

"Oh, isn't it, though? Well, ever since it was in the paper friends of mine have been hanging around our house thinking I have a private supply of something to drink in my cellar."

Some gems of wisdom for the automobilist are reproduced here from among the replies made by ladies in answer to a list of questions in their examinations for automobile drivers' license:

Q.—If your engine stalls going uphill what do you do?

A.—Try and start it.

Q.—In letting the car stand, which side should be next to the curbing?

A.—The side which is nearest the sidewalk.

Q.—What should you do if the steering gear broke?

A.—Go to the nearest garage and have the man fix it.

Q.—Which has the right of way, a car on a main thoroughfare or a car on a bisecting street, when they approach?

A.—The one that gets there first.

Q.—What is the proper precaution to take when backing your car?

A.—Reverse your engine.

Q.—What is the accelerator?

A.—The name of that something that has something to do with something inside of the car.

Q.—What is the charging indicator?

A.—Your bill for garage, gas and oil.

Q.—What is the first rule of the road?

A.—Don't run into anything.

Q.—Where should you have your license number?

A.—On your car.

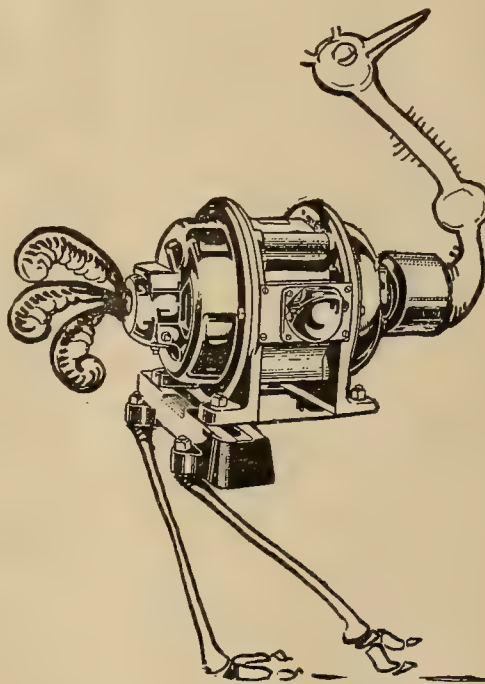
Q.—What is meant by "short circuit"?

A.—Going around the shortest way.

Q.—When batteries run out, what must you do?

A.—Get them back or get new ones.

* * *



ELECTRICAL HYBRIDS — III.

The Electric Dynamostrich

The Electric Dynamostrich is unpleasantly superior, But yet he is magnetic when excited, it is said; All motorists and golfers he considers quite inferior — To boast about their driving when his drive would knock 'em dead.

